PILOT/AIR TRAFFIC CONTROLLERS COMMUNICATIONS ISSUES

(101-77)

HEARING

BEFORE THE

SUBCOMMITTEE ON AVIATION

OF THE

COMMITTEE ON
PUBLIC WORKS AND TRANSPORTATION
HOUSE OF REPRESENTATIVES

ONE HUNDRED FIRST CONGRESS

SECOND SESSION

MAY 24, 1990

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SUBCOMMITTEE ON AVIATION
HEARING ON
PILOT/AIR TRAFFIC CONTROLLER COMMUNICATIONS ISSUES

9:30 a.m.
Thursday, May 24, 1990
2167 Rayburn House Office Building

SUMMARY OF SUBJECT MATTER

The Subcommittee will receive testimony on pilot/air traffic controller communications issues. The hearing will explore the safety implications of problems in communications between pilots and air traffic controllers and what is being done to resolve these problems, the Federal Aviation Administration's research efforts to resolve communications difficulties between pilots and controllers, and the problems in communications involving controllers or pilots for whom English is a second language.

I. Safety and Pilot/Controller Communications Problems

Pilot/controller communications problems have been identified as causes or factors in a number of air carrier and general aviation accidents. The most significant was the collision of two Boeing 747s on a runway at Tenerife on the Canary Islands in 1977. This accident resulted in the largest loss of life of any aviation disaster in history, 583 fatalities. Among the causes and contributing factors of the accident were two aircraft radio transmissions occurring at the same time, making it difficult for one of the aircraft to hear a critical communication from a controller. The accident report also cited incorrect use of English in a critical communication by one of the flightcrews. This particular communication was interpreted by the controllers to mean that the crew of one of the aircraft was prepared to takeoff, when the crew was actually communicating that it was taking off.

More recently, an Avianca Airlines Boeing 707 (AVA052) enroute from Bogota, Columbia to John F. Kennedy Airport (JFK) in New York crashed in Cove Neck, New York on January 25, 1990. According to the National Transportation Safety Board,

> "The critical nature of [the aircraft's] fuel state was not conveyed properly by the flightcrew of AVA052 during communications with NY ARTCC, NY TRACON and JFK TOWER. Also, air traffic controllers at all three facilities apparently did not perceive the urgency of AVA052's fuel state because of the nonstandard phraseology that was used by the flightcrew. As a result, the information was not forwarded from facility to facility, and AVA052 was not provided with additional ATC assistance and traffic priority consistent with its critical fuel status."

Upon arrival, in the New York vicinity, the crew executed a missed approach, and then made a second attempt to land at JFK. While on the second approach the aircraft ran out of fuel and crashed 15 miles short of the airport. Seventy-three of the 158 people on board the aircraft were killed and 82 were seriously injured.

The NTSB is continuing the investigation into the circumstances surrounding the crash of Avianca Flight 52. However, on February 21, 1990, NTSB issued safety recommendations stating that ". . . the Safety Board believes that immediate corrective action is needed to ensure that standard communication and coordination procedures and phraseology are used between commercial air carrier flight crews and air traffic controllers and among air traffic control (ATC) facilities." The Safety Board indicated that preliminary evidence showed that there was ". . . incomplete communication between the flight crew of Avianca Flight 52 and controllers at the New York Air Route Traffic Control Center, the New York Terminal Radar Approach facility and JFK Air Traffic control tower and during inter-facility coordination among those air traffic control facilities."

Beyond accidents, safety can be analyzed by the occurrence of incidents in the system, such as improper runway incursions. Incidents are events that pose a threat to safety but do not result in an accident. Last month, the FAA issued a report entitled "Reducing Runway Incursions." The report is not a quantitative analysis of the causes of runway incursions, but it does identify a range of causes.

Most improper runway incursions are pilot caused. Among the pilot-related causes of runway incursions is the failure to understand clearances and instructions from controllers. The report cited:

o Pilot difficulty in interpreting clearances at airports with complex runway and taxiway configurations.

o Pilot difficulty in actually hearing messages via radio.

- The use of non-standard phraseology by pilots.

- Pilot complacency and distractions resulting in responses to communications they expect to be receiving, rather than the ones they actually receive.

With respect to controller caused incursions, the report also found that errors in sending or receiving communications were not as pronounced as other factors such as forgetfulness, misjudgments of traffic separation, lack of coordination in the tower, or inattention.

The NTSB has also determined that a number of serious near mid-air collisions which it has investigated were caused by communications problems between pilots and controllers.

II. Recent FAA/Industry Actions

The issue of pilot air traffic controller communications problems has received a great deal of study and analysis. Through a joint partnership, the Federal Aviation Administration, the Department of Defense, and aviation industry groups issued a document in November 1988 titled a "Call to Action; Pilot/Controller Communication Awareness". This document identified twelve areas of concern regarding aviation safety in communications between pilots and air traffic controllers, and made specific recommendations in each of these areas to improve communications.

The following are some of the findings from the report.

- One of the more predominant communications problems is the confusion resulting from similar sounding call signs or duplicative instructions issued to similar aircraft types.
- There are frequent problems resulting from difficulties experienced by air traffic controllers in hearing and completely understanding pilots' radio transmissions due to radio technical difficulties.
- An overwhelmingly large number of daily incident reports are directly attributable to the use of improper air traffic control phraseology resulting in miscommunications by both controllers and pilots.
- There are significant problems of inadequate language enunciation including voice volume, rate of speech, and voice inflections.

- The report indicated that pilots or controllers not using headsets were at a communication disadvantage and that numerous incidents have occurred when communications are made via a speaker.

- The report found that improper mechanical use of a radio by pilots and controllers causes communications problems. For example, speaking on the radio while some one else is speaking, or speaking into the radio before the microphone has been fully keyed cuts off part of the transmission.

- The report stated that there were significant problems in communications among flight crew members within the cockpit with regard to information received from air traffic controllers.

- Mistakes in communication between air traffic controllers are frequent, particularly in air route traffic control centers when there are multiple controllers on the same frequency.

- Problems have occurred when someone keys a microphone button and it becomes stuck in the "on" position without the user being aware of the stuck button. All transmissions on that frequency are blocked until the microphone becomes unstuck.

- Problems have resulted from pilots failing to read back instructions from air traffic controllers. Also, air traffic controllers do not allow enough time in some circumstances for a pilot to read a clearance back. These problems are particularly prevalent in congested areas.

- Problems in communications were identified when initial radio contact between the pilot and controllers is incomplete or deficient of necessary flight information.

The hearing will receive testimony on the status of implementing the recommendations made in the "Call to Action" to resolve these problems.

III. Problems in Communications when English is a Second Language

The International Civil Aviation Organization (ICAO) and other experts have studied communications impediments between pilots and controllers for whom English is a foreign language.

ICAO is an organization of 162 member countries. ICAO establishes agreements on the standards for the operation of safe, efficient and regular air services.

ICAO has established procedures for air traffic services and aeronautical telecommunications which take into account problems of language interpretation. Among these procedures is that international air traffic control communications, regardless of their locale, shall be in English. Also, ICAO has developed standard phraseology and vocabulary to be used in communications between controllers and pilots. These procedures are suppose to be used by pilots and air traffic controllers of countries belonging to ICAO.

The issue of English as a foreign language has received a great deal of attention and study by industry organizations as well. Responding to problems involving English as a foreign language, the International Air Line Pilots Association issued a paper in 1984 describing communications problems commonly encountered by foreign crews flying in the United States. The paper criticized the United States for not complying with ICAO standards. Many of the ICAO standards are based on air traffic control procedures in the United States, however a number of exemptions have been granted to the United States to deviate from ICAO procedures for air traffic operations in the United States. Among the problems in U.S. ATC procedures cited by the paper were:

- Air traffic control clearances and information are given in non-ICAO form using English, but using phrases which widely exceed the limited ICAO English vocabulary.

- The language that controllers use is frequently colloquial slang or American-English with a strong regional cadence that makes understanding very difficult or impossible for foreign flight crews.

- Meteorological reports often do not use international format or measuring units.

The report also noted that pilots for whom English is a second language found that U.S. air traffic controllers often give "machine-gun"-like clearances, making the instructions very difficult to understand and compliance difficult.

The Subcommittee will receive testimony on what is being done to resolve these problems.

ANTICIPATED WITNESSES

Representatives from the following organizations will present testimony.

- Federal Aviation Administration

- National Transportation Safety Board

- National Aeronautics and Space Administration

  NASA is responsible for the Aviation Safety Reporting System (ASRS), in which pilots and controllers report voluntarily occurrences of incidents and accidents. ASRS uses the collected information to determine issues for research and development projects. Data collected by ASRS indicate widespread communications difficulties resulting in numerous safety incidents.

- International Civil Aviation Organization

  ICAO is an international organization with 162 country members. It sets standards for communications to be used by the member countries.

- Air Line Pilots Association

- National Air Traffic Controllers Association

- Air Transport Association

- Association of Professional Flight Attendants

  APFA represents 18,000 flight attendants employed by American Airlines. APFA is concerned with the hiring of foreign-national flight attendants and the lack of FAA regulations requiring flight attendances to have the ability to use English to issue instructions in the event of an emergency.

PILOT/AIR TRAFFIC CONTROLLER COMMUNICATIONS ISSUES

THURSDAY, MAY 24, 1990

House of Representatives,
Subcommittee on Aviation,
Committee on Public Works and Transportation,
Washington, DC.

The subcommittee met, pursuant to notice, at 9:45 a.m. in room 2167, Rayburn House Office Building, Hon. James L. Oberstar [chairman of the subcommittee] presiding.

Mr. Oberstar. The Subcommittee on Aviation will please come to order.

Bonjour, tout le monde. Je vous souhaite le bienvenue á cette séance de la Commission de l'Aviation.

Buenas dias.

Dobar dan.

U hrad mit u milnen, dammen und herren.

Buon giorno.

I want to open this hearing in the spirit in which it is convened, and that is the problem of communication. I might have added to all of those that it is English I speak the best. That is the heart of the problem. Communication between pilots and controllers in a world of aviation in which aircraft and crew—aircraft of many flags and crew of many nations—are communicating in the air and air to ground in what should be the lingua franca English, but in a dialect that sounds more like the Tower of Babel.

Understanding the difficulties of communication and what may go wrong and how we can do it better is the focus of this hearing. And it is the focus of many good-hearted and well-intentioned efforts within the Federal agencies and the various private sector companies that are saddled with the problem of communication.

Understanding how we can better communicate to avoid those misunderstandings—it is difficult enough to communicate in that highly-technical, rapid-fire, machine gun, staccato-like communication of the controller to the pilot in English, even when it is your mother tongue. But when it is not your mother tongue and there are nuances you don't understand, then difficulties begin.

I don't lay claim to many gifts, but one is language. I speak a few, and I have taught English as a foreign language. I understand the difficulties of learning English and pronouncing English. But there is something that goes beyond communicating the words and the grammar in a foreign language, and that is the spirit, the mind set, the emotional content of words and phrases.

When it is your language you know what you mean, and the inflection often says more than words, themselves, can say. When you are learning another language you learn the words and you learn the grammar, but it takes a very long time to learn the culture and to absorb it and to understand how shifts in inflection can reflect shifts in meaning. Understanding that, I think, is something that is essential to the purpose of this hearing and to improving communication.

There are whole schools at universities that focus just on communication.

On my way back from our son's graduation from Notre Dame this weekend I had the happy occasion of sitting next to a college professor who is working on a project in communication. The focus of her project is how women in public life communicate differently or the same as and in what respects as their male counterparts. Here is a person doing a rather intensive research project on how we communicate with each other in our own language. How much more difficult it is when at Heathrow you have 70 nations flying in and out and communicating with the tower and with en route controllers.

We have made tremendous advancements in technology and digital electronics and on-board avionics and computer capabilities and telecommunication switches and radar imaging, but we're still dependent on the voice to transmit ideas and information, instructions, and guidance. And when you read the transcript of the tapes following a crash there are often the terms "What did he say?", "Repeat that.", "Say it again." in English. How much more difficult when it is in another language and another accent.

As congestion grows, as air traffic expands—as we anticipate it will—we are creating the conditions with growth with legislation we are soon going to bring out of this committee and the Airport Improvement Program and the Facilities and Equipment programs to accommodate the growth in domestic travel, as travel grows in Europe—the Europe of 1992—as the East European nations commercialize, we are going to have more accidents in the air.

It may well be that the tragedy of Tenerife was at least in part due to some communication error. There is the all-too-recent, painful experience of Avianca in New York. The safety implications are not just theoretical, they are not just an exercise in phonetics and diction; they are an exercise in life or death.

So I want to know what it is that the Federal Government community is doing in this area, what it is that the private sector is doing, and how you are adjusting to the increasing demands on the human factor in aviation. We have talked about the human factor in aging aircraft, in maintenance, and in the electronics. Now we are talking specifically about something that has been an interest of mine for at least five years now, and we are going to pursue this matter without any fixed agenda of where we might wind up.

This is an exploratory process. Whether additional legislation is needed, whether additional programs are needed, or maybe at the end of it I have to set up an "English as a Second Language" course for pilots—which I'm quite capable of doing, having taught English to Haitian military personnel—somewhere in there is going to be the answer or a guidepost to the answers. I look forward to today's testimony.

The Chair recognizes the gentleman from New York, Mr. Boehlert.

Mr. **Boehlert**. I'd like to thank the chairman for his very eloquent opening statement. It is one of the best opening statements I have heard in my years on Capitol Hill.

Two things: first of all, I ask unanimous consent that the statement of the vice chairman of the full committee, the Honorable John Paul Hammerschmidt, be included in the record at this point.

Mr. **Oberstar**. Without objection, so ordered.

[Mr. Hammerschmidt's prepared statement follows:]

STATEMENT OF HON. JOHN PAUL HAMMERSCHMIDT

Mr. Chairman, as you know, last January, an Avianca Airlines jet crashed in Cove Neck, NY, on its way to JFK Intenational Airport.

Earlier, as the plane had flown from Columbia up the east coast of the United States, it was placed in holding patterns 3 times by air traffic controllers. During these holds, and as he approached JFK, the pilot repeatedly told controllers that his plane was low on fuel and that he needed priority handling. However, he never used the standard phrase for declaring a fuel emergency. When the plan ran out of fuel and crashed, 73 people died.

The National Transportation Safety Board (NTSB) is still investigating this accident. But they have already begun to express concerns about the communications between the pilot and the controllers involved. The NTSB recently stated that "the critical nature of the fuel state was not conveyed properly by the flightcrew" and that the "air traffic controllers * * * did not perceive the urgency of [Avianca's] fuel state because of the nonstandard phraseology that was used by the flightcrew." In short, it appears that the failure of the pilot to use the proper language for declaring a fuel emergency was a major factor in the accident.

This sort of pilot-controller communication problem had been a matter of concern even before the Avianca accident. In 1988, a government/industry task force issued a "call to action" on pilot-controller communications problems. The document listed the various communication problems that can arise and the measures that should be taken to address them.

But although "the call" was issued, it is not clear that much "action" has been taken. A recent survey of controllers found that more than 90 percent still find communications with pilots to be a problem.

Therefore, it is timely and appropriate that we hold this hearing in order to call attention to the problem and give more impetus to proposed solutions. I commend you for calling this hearing, Mr. Chairman, and I look forward to the testimony of the witnesses here today.

Mr. **Boehlert**. And, secondly, I would like to say that you have asked two very important questions: what are we doing?—"we" being the Federal Government. And also: What is the private sector doing? I think that is going to lead us to the most important question of all: What more needs to be done?

I think we are all receptive to ideas, and we've got a very distinguished panel here. I look forward to hearing from the panel.

I note in the briefing paper provided us by the staff—the very competent, professional staff—pointing out that in the largest loss of life in any aviation disaster in history, 583 fatalities when the two Boeing 747s crashed on the runway in the Canary Islands in 1977, there was a communications problem. And communication, according to the report, was interpreted by the controllers to mean that the crew of one of the aircraft was prepared to take off when the crew was actually communicating that it was taking off. So I think that outlines very vividly in very poignant terms—a loss of 583 lives—the need for some action here.

I look forward to the guidance that we will receive from our distinguished witnesses.

Thank you, Mr. Chairman.

Mr. OBERSTAR. I thank the gentleman—especially for those kind remarks.

The gentleman from Iowa, Mr. Lightfoot?

Mr. LIGHTFOOT. Thank you, Mr. Chairman.

I agree with Mr. Boehlert comments about your opening remarks. I think you addressed very clearly the problem we have with international languages, but I feel we also have a problem with our own folks right here in the United States.

As a flight instructor, one of the things we try to do is to teach students the proper procedures to use on the radio. This past weekend, due to inclement weather in the Middle West, I spent about seven and a half hours flying on solid instruments, and I think that tends to tune you in just a little bit tighter to what some of the chatter is that goes on. Unfortunately, with the advent of the CB radio, it seems a lot of our pilots have come up with a shorthand version of their own which does not fit within the regiment of normal communications that we use in air traffic controller. As a result, there is a lot of misunderstanding, and as the chairman mentioned, to ask for things to be repeated.

Controllers are not totally blameless in this, either. I was given two wrong headings by a controller who probably was an apprentice just learning, because there was another voice that came on the radio after the second mistake. I assume it was his supervisor. I was flying an aircraft whose N number was 74-Gulf. There was a 74-Foxtrot in the air, and he kept confusing the two of us. Fortunately, we happened to be some distance apart.

I had an experience some years back going into Nashville, Tennessee, with an old air traffic controller who obviously had been there for years, had a very deep, resonant voice, very articulate, spoke very plainly and slowly so everyone could understand. It was interesting, as we were working into that airport. If my count was correct, he was working about 12 or 13 aircraft going in there that day. No one was having any problems. It was working smoothly because no one had to repeat anything. At that point in time I was going up to Hershey, Pennsylvania.

I got into an area here in the Eastern corridor and we had one of these guys that was several years younger, from the sound of his voice, but was machine-gunning all the information to the pilots and it sounded like he had 500 airplanes in the air. When I counted, he was working three different N numbers.

So a lot of it is in how it is presented. There is an old joke that they tell—and I was told this was true. When the old Teterborough tower operated in New York this pilot came on. It was obvious from his accent he was from Georgia or somewhere in the South. He asked for his IFR clearance. In typical New York fashion—excuse me, Mr. Boehlert—that's downstate New York—the ground controller just machine-gunned this guys clearance back to him. There was a pause, and, of course, as you gentlemen know, you are supposed to acknowledge and read back your clearance and there wasn't a read-back. The controller gave the N number again and said, "Did you copy." There was another pause and you could hear the mike click and the old pilot came on and he said, "Say, is any of that stuff you told me important?" [Laughter.]

And the controller was somewhat shocked and he said, "Well, yes, it is all important." And the pilot said, "Well then read it to me like it was." So I guess for the next hour you could copy Teterborough with something less than a degree in shorthand.

So there are problems on both sides, and pilots and air traffic controllers are both to blame.

Mr. Chairman, I have a prepared statement. I'd like unanimous consent to ask it be put in the record. I look forward to today's hearings.

Mr. **OBERSTAR**. Without objection, so ordered. I'd also like to insert Mr. Costello's prepared statement in the record at this point.

[Mr. Lightfoot's prepared statement follows:]

STATEMENT BY CONGRESSMAN JIM LIGHTFOOT

Mr. Chairman, thank you for holding this hearing examining the safety ramifications of communication problems arising between pilots and air traffic controllers. In light of the recent Avianca crash last January, I am pleased the National Transportation Safety Board has issued recommendations noting the importance of coordinated procedures and communication formats for pilots and air traffic controllers. Today's hearing will also provide the subcommittee the opportunity to receive testimony on those recommendations made in a 1988 report addressing this issue. Additionally, today's hearing will analyze the problems in communications when English is a second language.

I understand a recent survey of air traffic controllers indicated that 34 percent think that pilot/controller communications is a frequent problem. Yesterday, I had the opportunity to receive input from an air traffic controller from my State of Iowa. He noted that one of the biggest problems was the use of nonstandard phraseology. He also noted that air traffic controllers were just as much at fault in using nonstandard phraseology as he pilots.

He also cited an incident that occurs frequently which I will relate to you:

The air traffic controller will ask the pilot's "climb and maintain one-zero-thousand." Pilots will often misinterpret this and ask, "climb to 15?" This particular controller indicated that FAA has proposed regulations to correct this type of situation so the air traffic controller can simply ask the pilot "climb and maintain at 10,000." This is just one example of the clarifications needed.

I'd like to thank you again Mr. Chairman for holding this hearing.

[Mr. Costello's prepared statement follows:]

PREPARED STATEMENT BY REPRESENTATIVE JERRY COSTELLO, ILLINOIS

Mr. Chairman, I am pleased to be here today as the Subcommittee receives testimony on the issue of flaws in communications between pilots and air traffic controllers. The ability of these personnel to communicate effectively is vital to the safety of air travel.

Unfortunately, it seems that there are some communication gaps which jeopardize the crews and passengers on U.S. and international flights. Investigations by the National Transportation Safety Board and a recent report by the Federal Aviation Administration have revealed that these gaps include problems with radio transmission; use of unclear phraseology by pilots and air traffic controllers; and problems with English as a second language in international flights.

It seems to me that these problems can be resolved, to the benefit of both the airline industry and airline passengers. With some relatively simple changes in technology and procedure, accidents such as the crash of the Avianca Airlines Boeing 707 on Long Island this past January can be avoided, and hundreds of lives can be saved. I commend the witnesses here who have been involved in the study of this problem, and I look forward to hearing from them regarding their results and the implementation of their recommendations. I particularly commend you, Mr. Chairman, for holding this hearing so that they can testify.

Mr. **OBERSTAR**. The gentleman's delivered remarks were a lot better than any written statements.

The gentleman from Texas, Mr. Laughlin?

Mr. Laughlin. Thank you, Mr. Chairman. I have no statement.

Mr. Oberstar. The gentleman from California, Mr. Packard?

Mr. Packard. Thank you, Mr. Chairman.

I am looking forward to this very excellent panel of witnesses. Certainly the air traffic control problems we have today are significant and it is important that we find solutions, but also we are looking at a future time when we will be upgrading and modernizing our traffic control system with a lot of electronic equipment. It will be interesting to see how we blend the problems of today in with the concerns and the solutions of tomorrow.

I'm looking forward to the testimony.

Mr. Oberstar. Thank you.

The gentleman from California, Mr. Mineta.

Mr. Mineta. Mr. Chairman, let me just congratulate you and Mr. Clinger for holding these hearings. There is, without a doubt, nothing more important than this whole area of air traffic control communications with the aircraft. Having the opportunity just about every weekend to have some time in the cockpit as we fly back and forth cross-country, and seeing and listening to the system and talking to the crews, I really think, between whatever is happening in technology, as well as any improvements we are making in the system, there is a lot that we have got to be doing.

I want to thank you again for your leadership on this, Mr. Chairman. I look forward to the hearing, as well as the testimony from everyone.

Mr. Oberstar. Thank you.

Mr. Laughlin.

Mr. Laughlin. Mr. Chairman, I didn't realize we were in the opening statement portion of the hearing because I didn't have my interpreter to help me as Mr. Lightfoot was speaking down at the other end. [Laughter.]

And since I'm the only member from the Southern part of the United States here today I do want to tell the members of this panel I hopefully won't be confused when you're speaking. I didn't realize that was the portion of this hearing we were in.

Mr. Lightfoot, next time I come in late, please have an interpreter tell me where you are. That will help me.

Mr. Lightfoot. You missed the whole point. The problem was with New York. [Laughter.]

Mr. Laughlin. Thank you very much. We look forward to hearing your testimony this morning.

Mr. Oberstar. On that note we will begin. I think it underscores the focus of the hearing.

We have organized witnesses in panel fashion today to expedite the presentations. Our first panel consists of: Mr. David Kelley, Chief of the Operational Factors Division at the National Transportation Safety Board; John S. Kern, Deputy Associate Administrator for Regulation and Certification at the FAA; Doctor Curtis Graeber, Chief of the Aeronautics Human Factors Branch at NASA, Ames Research Center; and Mr. Don Newman, U.S. Representative at ICAO. Please introduce your associates as you speak.

Let us begin with Mr. Kelley.

TESTIMONY OF DAVID R. KELLEY, CHIEF, OPERATIONAL FACTORS DIVISION, NATIONAL TRANSPORTATION SAFETY BOARD, ACCOMPANIED BY RICHARD JAMES WENTWORTH, DEPUTY DIVISION CHIEF FOR AIR TRAFFIC CONTROL; AND JOHN S. KERN, DEPUTY ASSOCIATE ADMINISTRATOR FOR REGULATION AND CERTIFICATION, FEDERAL AVIATION ADMINISTRATION, ACCOMPANIED BY NORBERT A. OWENS, DEPUTY ASSOCIATE ADMINISTRATOR FOR AIR TRAFFIC; H. CLAYTON FOUSHEE, CHIEF SCIENTIFIC AND TECHNICAL ADVISOR FOR HUMAN FACTORS

Mr. KELLEY. Good morning.

Mr. Chairman and members of the committee, I want to thank you for this opportunity to present the views of the National Transportation Safety Board concerning the problems associated with pilot and air traffic controller communications. You are to be commended for your concern about this problem and its effect on the safety of the traveling public throughout the Nation.

I'd like to introduce myself. I'm David R. Kelley, Chief of the Safety Board's Operational Factors Division. On my right accompanying me is Mr. Richard Wentworth, the Assistant Division Chief for Air Traffic Control.

We at the Safety Board share your concerns. The Safety Board believes that deficiencies in communication, which often result in runway incursions and near midair collisions with their attendant potential for an actual collision, represent one of the most serious problems affecting commercial aviation operations today.

As Congressman Boehlert mentioned, the 1977 ground collision of two Boeing B-747 airplanes at Tenerife Airport in the Canary Islands remains as a grim reminder of the consequences of incomplete or misunderstood communications between pilots and controllers. As he said, there were 583 fatalities as a result of that collision—the largest number of lives lost in any aviation accident in history.

The Safety Board has investigated numerous accidents and incidents involving pilot/controller communication problems.

The potential for a catastrophe involving as many or more fatalities than the Tenerife accident occurred in March, 1985. Two Northwest Airlines' DC-10 airplanes nearly collided at the Minneapolis-Saint Paul International Airport. One airplane was taking off from a runway, while the other airplane was taxiing across the same runway. A collision was barely averted when the captain of the airplane taking off rotated his airplane prematurely and overflew the taxiing airplane by an estimated distance of 75 feet. There were 501 persons aboard the two DC-10s, and there were numerous other commercial airliners taxiing nearby.

The Safety Board determined that the runway incursion occurred because of incomplete and misunderstood verbal communications between the local and ground controllers in the Minneapolis tower.

More recently, on January 25, 1990, Avianca Airlines Flight 052, a Boeing 707-321-B, crashed near Cove Neck, New York, resulting in 73 fatalities and 82 serious injuries to the occupants.

The Safety Board believes that incomplete communication between the flight crew and controllers may have contributed, at least in part, to that accident. Preliminary evidence gained from the investigation of the Avianca accident indicates that the flight crew did not properly convey the critical nature of their aircraft's fuel state to three different air traffic control facilities. Because of the nonstandard phraseology that was used by the flight crew, the controllers did not perceive the urgency of the flight's fuel state and, as a result, the information was not passed from facility to facility and Avianca was not provided with traffic priority to ensure a safe landing.

On March 1 of last year a near midair collision occurred seven miles west of the Houston International Airport at 3,200 feet. The controller cleared the Continental pilot to "turn left to 360." The controller's use of the word "360" is not in accordance with the Controllers' Handbook and was understood by the Continental crew to mean "make a 360." The near collision resulted when Continental, instead of turning left to a heading of 360, made a 360 degree turn to the right and passed the TWA flight at the same altitude with only 480 feet lateral separation while in instrument meteorological conditions.

Finally, on February 27 of this year American Airlines Flight 158, a DC-10, and American Airlines Flight 341, an MD-80, came within 100 feet vertical and one mile horizontal separation at 10,000 feet near the Dallas/Fort Worth Airport. The operational error occurred when the controller issued a clearance to Delta Airlines Flight 558, a B-757, to descend to 5,000 feet; however, American 158 acknowledged the clearance and started a descent from 11,000 feet. The controller failed to detect that the wrong flight crew had responded to the clearance.

I believe that these incidents exemplify the problem of imprecise or improper communications. Our investigations have indicated that the problem affects pilots and controllers alike. One or both lack a complete understanding of the intent of the other and, as a result, fail to adhere to or comply with a clearance, an instruction, or other established procedures. In short, there is an incomplete transfer of information.

Communications problems manifest themselves in many forms. Recently, Battelle's Aviation Safety Reporting System Program Office completed a research study concerning communication problems. The study reviewed reports submitted by controllers and listed some leading communication errors; for instance: wrong heading or altitude assignment, inappropriate or misleading instructions, and issuance of clearances to the wrong aircraft. Also, they listed the use of non-standard terminology in clearances and poor controller radio techniques; and, finally, failure to detect and correct erroneous flight crew readbacks.

Factors listed as contributing to these communication errors were listed as: Heavy traffic causing controller overload, similar aircraft call signs, congested frequencies, and combined ATC positions or sectors.

The study also reviewed flight crew performance reports and listed some errors as: confusion over altitude assignment, failure to request clarification, and failure to adhere to a heading assignment.

The leading factors contributing to these errors were: frequency congestion, radio communications, and traffic watch.

The study's principal conclusion was that, "A substantial number of controllers are handling too much traffic, or traffic mixes that are too complex." The study recommended that FAA continue to hire and train new controllers and to implement more stringent traffic management procedures.

The Safety Board concurs with the findings and recommendations of this study.

The FAA has been very responsive to the urgent safety recommendations issued by the Safety Board concerning the Avianca accident. As a result of these recommendations, the FAA issued an action notice requiring distribution of the recommendation letter to appropriate flight standards organizations within the FAA and to each air carrier involved in commercial operations in the United States' national airspace system.

The FAA also required that all controllers be briefed on the circumstances of the Avianca accident and on the importance of accurate pilot/controller communications.

Following our investigation of an operational error at New York TRACON, we issued eight safety recommendations to the FAA in August of 1989. However, the FAA did not fully concur with all of the Safety Board's recommendations.

The operational error occurred when the controller confused similar flight call signs of Trans World Airlines Flights 843 and 834 and issued clearances to one flight that were actually intended for the other.

Three of our recommendations to the FAA addressed the need for corrective actions concerning duplicate and similar flight call signs that are in simultaneous use. The FAA's response indicated that they did not concur with these safety recommendations.

More recently, in December of 1989, the Safety Board issued 11 safety recommendations to the FAA as a result of our investigation of a fatal accident near Adams, Massachusetts. The accident occurred when the controller allowed the pilot of a Cessna 172 to maintain an altitude that was below the minimum vectoring altitude in that area and the airplane struck high terrain.

One of the ensuing recommendations urged the FAA to identify and correct communication errors that pilots make in response to their transmissions. The FAA's response stated that it had taken previous actions to address this issue and therefore no need existed to issue a general notice at this time.

One of the efforts mentioned by the FAA was the document, "Call to Action," which was developed in 1988 by a joint FAA/industry working group to foster improved communications between pilots and controllers. The Safety Board believes that "Call to Action" is an excellent document for use in training programs and to improve communications between pilots and controllers. However, the FAA, themselves, and the Safety Board have found that the distribution of "Call to Action" was apparently too restricted and, as a result, its effectiveness was limited.

An FAA report stated that most of the pilots who were interviewed during a recent systems safety and efficiency review were not aware of this major communication awareness program. Safety

Board investigations of incidents involving communication problems also confirm that the training aid did not reach all pilots and controllers.

Ultimately, air-to-ground voice communications will be augmented with the implementation and use of the Mode Select Beacon System—MODE S. MODE S, with its digital data link, will provide a discrete addressability through use of a surveillance radar on the ground and a transponder in the airplane. This link will facilitate exchange of weather information, initially, and structured ATC clearances and advisories during the second phase of development.

For example, the FAA and two major U.S. air carriers are currently conducting a research and development program at Chicago O'Hare International Airport in which the communication of ATC pre-departure route and altitude clearances is done via data link. Approximately 700 pre-departure clearances are transmitted daily directly to the cockpit or to the flight's departure gate. The O'Hare Airport clearance delivery controller does not participate in any manner in issuing these clearances. The FAA estimates that this program has resulted in a 60 percent reduction in voice communication and controller workload for O'Hare pre-departure clearance deliveries.

In summary, Mr. Chairman, the Safety Board believes that erroneous communications between pilots and controllers endangers the integrity of the national airspace system. As air traffic and frequency congestion increase, effective management of the ATC system will be achieved only through the use of clear, standard, complete, and understood communications between system users and controllers. The Safety Board will continue to monitor this problem and to urge the FAA to continue to focus on this hazard to aviation safety.

Mr. Chairman, that concludes my formal statement. I will be pleased to respond to any question that you or the members have.

Mr. OBERSTAR. Thank you. We will have questions. I appreciate that very thorough presentation.

We will go now to John Kern. With him is Doctor Clay Foushee and Mr. Norb Owens.

Mr. KERN. Thank you, Mr. Chairman and members of the subcommittee.

It is a pleasure for us to appear before you today to discuss the issue of effective communications between pilots and air traffic controllers, the two most critical links in maintaining the safety and efficiency of our national airspace system.

Accompanying me today, as you mentioned, are Mr. Norbert A. Owens, our Deputy Associate Administrator for Air Traffic, on my left; and Doctor H. Clayton Foushee, the FAA's Chief Scientific and Technical Advisor for Human Factors, on my right.

Effective communications between pilots and controllers have been an ongoing concern to the aviation community since before the radio became the primary means of aviation communications. Equally important, in our view, is the use of effective communications to promote safety in the cockpit. We view each form of communication—pilot/controller and pilot/first officer/flight engineer—to be critical for the continued safety of our national airspace system.

The FAA has been actively pursuing ways of improving communications between pilots and controllers. In the last two years, alone, we have made over 20 changes to the Controller Handbook to improve or clarify communications.

In June, 1989, the Air Traffic Management Team, of which Mr. Owens is a member, recommended that all air traffic control phraseology be reviewed and, if necessary, changed to improve clarity and understanding. As a result, 40 specific recommendations were made and are undergoing a national review before being incorporated into our Controller Handbooks.

In addition, there are several efforts underway at the FAA Academy to revise hearback/readback training for controllers and to strengthen overall controller communications.

As part of our ongoing concern about the use of effective communications, the FAA, the Department of Defense, and the aviation industry launched a nationwide communications awareness initiative in early 1988, as you have heard, entitled "A Call to Action." This initiative was designed to heighten the aviation community's awareness of the need for effective communications to reduce system operations problems, increase user professionalism, and enhance system safety.

The initiative focused on 12 areas of concern, ranging from similar-sounding alphanumerics and controller hearback problems to initial radio contact, stuck microphones, and readback problems.

The distribution of "A Call to Action" was worldwide, with copies provided to ICAO and several foreign countries, as well as our entire air traffic controller workforce. The pilot community's distribution was handled by various user organizations and the FAA's Flight Standards Offices.

The 12 areas of concern identified in "A Call to Action" represent those that most commonly affect communications between the pilot and controller. I would like to stress, however, that the initiative was not an attempt to provide solutions to the problems that are extraordinarily complex, but was intended to raise the level of awareness within the entire aviation community of the extent of the communications problems facing pilots and controllers.

It should also be made clear that we have been seeking solutions to these problems prior to this initiatives.

The hearback/readback problem has received probably the most attention, with the publication of several air traffic service bulletins, special emphasis programs, and meetings with various user organizations.

Having identified some of the more common communications problems, the next step logically involved seeking their causes and continuing our work to develop solutions. Before outlining our approach to seeking long-term solutions, it is important to understand that effective communications also involve cockpit communications.

Communication among the flight crew members is just as critical to aviation safety as the pilot/controller communications. To address this problem, we have encouraged industry development and implementation of cockpit resource management programs, which I will highlight later.

We view the spectrum of communication problems as being within the broader context of what has become known as human factors. I think we all can agree that we are just beginning to fully comprehend the dimensions of the human factor in aviation. It is clear that we have not done enough to apply human factors technology to aviation environments. In many cases we have not invested in research necessary to systematically understand the dimensions of the human part of the issue. We now appreciate much more that human factors are central to all aviation safety activities.

Human factors problems have, of course, been with us for a long time. The facts speak for themselves. Human error has been a causal factor in 66 percent of fatal air carrier accidents, 79 percent of fatal commuter accidents, and 88 percent of fatal general aviation accidents.

Communication misunderstandings, one type of human error, are a major factor in operational errors, as this subcommittee well knows. The root causes of human errors, however, are poorly understood. That is why we are pleased to have Doctor Foushee with us at the FAA as our resident human factors expert. He comes to us after a distinguished career at NASA, and is internationally recognized as an expert in this field.

Partially as a follow-up to the "Call for Action" initiative and as a result of our recognition of the importance of human factors, we have begun an effort to focus on human factors relating to controller and pilot errors. This effort will research, identify, and establish a course of action related to pilot and controller errors.

As causes are identified and solutions proposed, they will be forwarded to our human factors coordinating committee to discuss implementation or support further research. When project development begins, benchmarks will be determined for full implementation.

This effort began in March of this year, and Mr. Owens and I both participated. The first issue that was addressed concerned controller operational errors caused by pilot readback errors which the controller did not hear. Such readback errors in some cases have led to pilot deviations. To counter those errors, we are currently studying all aspects affecting transmission and receipt of messages in the control room and in the cockpit. We will continue to examine possible solutions to pilot/controller communications problems.

With regard to the issue of English as a second language, earlier this week we polled several of our regions which handle large numbers of foreign air carriers currently. English as a second language was not perceived by our workforce as a significant problem in these air traffic facilities since our controllers give special attention to communications from foreign air carrier pilots.

As I noted earlier, the other critical area where effective communications must be maintained is in the cockpit between the flight crew members.

Since 1979, an increasing amount of evidence has shown that nearly 80 percent of air carrier accidents and incidents resulted in part from failure by a flight crew to make full use of readily-available resources. A long-term NASA research program noted that these accidents and incidents had many common characteristics.

The NASA research pointed out that the problems confronting flight crews had little to do with the technical aspect of aircraft performance. Instead, they were associated with poor group decision making, ineffective communications, inadequate leadership, or poor management.

In addition, airline training programs focused almost exclusively on the technical aspects of flying and did not take into account flight crew management strategies and techniques for managing a crisis in flight.

As a result, both government and industry began to realize that more training emphasis was needed on human factors that influence flight crew coordination and resource management. Briefly defined, CRM is the effective utilization of all available resources—hardware, software, and people—to achieve safe and efficient flight operations.

In December, 1989, the FAA issued an advisory circular to further encourage air carriers to develop cockpit resource management programs and to provide basic guidelines for such training. The advisory circular indicated that cockpit resource management training programs should include, at a minimum, an awareness phase, a practice and feedback phase, as well as a continual reinforcement phase where cockpit resource management principles are addressed on a long-term basis.

We further defined CRM in the advisory circular as being a comprehensive system for improved flight crew performance, which is designed for the entire flight crew population; extends to all forms of flight crew training; concentrates on attitudes and behaviors of flight crew members and their impact on safety; provides an opportunity for individuals to examine their own behavior and to make individual decisions on how to improve cockpit teamwork; uses the flight crew as the unit of training; and requires the active participation of all cockpit crew members.

As with the solutions being sought by the pilot/controller working group, behavioral change from cockpit resource management training cannot be accomplished in a short period, even if the training is well designed. Flight crew members will need time, awareness, practice and feedback, and continued reinforcement to learn lessons that will endure; nevertheless, we are encouraged that cockpit resource management will go a long way toward improving flight crew communications skills.

In addition to cockpit resource management, I would like to briefly mention two other innovative training programs that have a direct bearing on improved communications as a safety management resource: line-oriented flight training—LOFT—and the advanced qualification program—AQP.

The advent of sophisticated simulator training devices has greatly enhanced training of flight crew members in air carriers. Line-oriented flight training is a useful training method because it gives flight crew members the opportunity to practice line operations with a full crew in a very realistic environment. Line-oriented flight training allows flight crew members to handle a variety of scripted, real-time scenarios, which include routing, abnormal, and emergency situations. They also learn and practice cockpit resource management skills, including crew coordination, judgment, decision-making, and communications skills.

The advanced qualification program is an alternate means of qualifying, training, certifying, and otherwise ensuring the competency of flight crew members. Its objective is to provide more efficient training and to enhance professional qualifications to a level above that currently provided by the standards specified in our current regulations.

The concept of advanced qualification program encourages air carriers and recognized training centers to develop innovative training and qualification programs that incorporate the most recent advances in training methods and techniques, including simulators and other computer-based training devices.

Since improved and heightened communications awareness, cockpit resource management, LOFT training, AQP, and virtually every aspect of FAA's safety responsibilities involve the human factor, I would now like to provide you an overview of our national human factors program.

Our national human factors program will be comprehensive in scope and will include research aimed at the alleviation of human performance problems in all types of aircraft, in the air traffic control environment, and in the interaction of the two environments. It is intended to encompass both the operational and maintenance spheres of each environment.

The national plan has eight major research priorities:

One, automation and advanced technology. While automation eliminates some classes of errors, it can introduce new types of errors if not properly designed.

Two, aviation system monitoring capability. Human factors research is dependent on compiling good data in the operational environment.

Three, basic scientific knowledge of human performance factors. We must invest in the pursuit of basic knowledge and specific applications to arrive at human behavior answers.

Four, human performance measurement. There exists a need for the development of better research methodology and techniques for measuring human performance.

Five, information transfer. What are the most efficient and reliable ways to exchange safety information? What information should be available to each? And when?

Six, controls, displays, and work station design. Applying human factors techniques to the design and evaluation of controls and displays.

And number seven, training and selection. What training methods and selection criteria are needed to produce the best possible personnel?

Last, number eight, certification and validation standards. How do we translate the products of this plan into a concrete certification and validation guideline?

While this entire effort will be directed and coordinated by Doctor Foushee, it will be the product of a joint partnership between the FAA, NASA, DOD, the airline and manufacturing industry, and the academic community.

Much of the impetus for our national human factors program was the Aviation Safety Research Act of 1988, which authorized increased funding for human factors research. In addition, the Air Transport Association established a human factors task force made up of government, industry, and scientific representatives, which was a driving force in helping us identify the priorities for our human factors plan.

While there has been considerable attention paid over the years to human factors research by FAA, NASA, DOD, and academia, these efforts have not been systematically coordinated. What is fundamentally different today is that the government and industry managers and decision makers perceive that society may be nearing a point of diminishing returns on investments in technology, making investments aimed at the human element far more attractive.

We also have a high level of interest and commitment in Congress and the Executive agencies, as well as agreement among researchers and the operational community, as to what the human factors research priorities are and how to go about addressing them.

As I mentioned earlier, we have established in the FAA a Human Factors Coordinating Committee, chaired by Doctor Foushee and comprised of representatives of each of our major operational components—flight standards, air traffic, airway facilities—as well as our research and development organization.

The Human Factors Coordinating Committee is the focal point for all human factors initiatives. It formulates policy recommendations to the FAA executive board to ensure that appropriate research and development is accomplished and that research and development products are being appropriately applied to the various FAA operational organizations.

In fact, in the ten-year period prior to the enactment of the Aviation Safety Research Act, the FAA has spent nearly $60 million in human factors research and development, and the fruits of those efforts can be seen in many of our major systems acquisitions.

In our fiscal year 1991 budget request, we are seeking $17.2 million for human factors research. This sum represents the human systems and aviation medicine portion of our budget, but many of our facilities and equipment efforts have large human factors components, so the actual total is significantly larger.

We view this research and development budget request as essential to our human factors programs in flight crew and air traffic controller performance; the role of the human operator in automated systems; selection, training, and certification of flight crew and air traffic controllers; enhancing understanding of the human function in the complex air traffic control and cockpit environments; and increasing productivity and safe performance of agency personnel through application of human factors research.

In closing, I would like to note that the FAA, other government agencies, academia, and industry are now in the midst of a unique opportunity to begin addressing the broad array of human performance issues. I would like to assure this subcommittee that the FAA is committed to the development of human factors criteria to enhance and improve aviation safety.

Mr. Chairman, that concludes my prepared statement. We are prepared to answer questions at the completion of the following statements.

Thank you.

Mr. **Oberstar**. Thank you very much, Mr. Kern.

We'll continue with Doctor Graeber of NASA.

TESTIMONY OF CURTIS R. GRAEBER, CHIEF, AERONAUTICS HUMAN FACTORS BRANCH, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION—AMES RESEARCH, ACCOMPANIED BY WILLIAM D. REYNARD, DIRECTOR, AVIATION SAFETY REPORTING SYSTEM

Mr. **Graeber**. Mr. Chairman, I welcome this opportunity to appear before you to discuss NASA's aviation safety research activities which address the issue of pilot/air traffic controller communications.

I am responsible for the aeronautical human factors research program at NASA Ames Research Center, which includes the subject of cockpit/air traffic control communications, as well as the management of the Aviation Safety Reporting System—better known as ASRS.

Accompanying me on my left is Mr. William Reynard, the Director of the Aviation Safety Reporting System.

I will briefly discuss relevant research and analyses carried out within NASA's Aeronautics Research and Technology Program directed at understanding and reducing human errors within aviation operations. These research activities can be broadly divided into two categories: Those which deal with understanding and eliminating avoidable safety problems within the current National Airspace System; and those which attempt to develop new technological solutions to existing and foreseen problems. These activities are now conducted in close cooperation with the FAA.

The Aviation Safety Reporting System has been a major contributor to the understanding of pilot/air traffic controller communication problems. ASRS, established in 1976, is operated by NASA for the FAA to assist in the identification of unsafe conditions and prevention of avoidable accidents. It does so by means of a confidential, third-party reporting system whereby pilots, air traffic controllers, and others report actual or potential discrepancies and deficiencies involving the safety of aircraft operations without fear of punitive consequences.

In the initial five years, 1976 through 1981, 70 percent of the 28,000 reports noted problems in the transfer of information within the aviation system. Since 1976, approximately 140,000 ASRS reports have been filed, and information transfer problems continue to represent the largest category of reports.

Output from the ASRS has two basic functions: First, to notify the aviation community of the existence of alleged hazards in the system; and, second, to attempt to explain why certain conditions or situations exist.

The first function is accomplished through alert bulletins and through Callback, a monthly safety publication. The second function is accomplished through technical papers describing the results and conclusions drawn from analyzing ASRS reports. These papers are made available publicly through normal NASA publication channels.

Also, we conduct database searches of the ASRS in response to requests by the FAA, the NTSB, Congressional offices, and other interested parties in the public and private sectors. Reports generated from ASRS data provide a broad database for NASA aviation safety research.

Certain caveats apply to the use and interpretation of ASRS data. All ASRS reports are voluntarily submitted, and thus cannot be considered a random sample of the full population of like events. Further, not all pilots, controllers, or other participants in the aviation system are equally aware of ASRS or are equally willing to report an accident; thus, the data may reflect a reporting bias. Nevertheless, we believe that the ASRS data represent a conservative measure of the true number of incident reports.

Recent and preliminary ASRS data on communications problems are included in the tables provided for the record. These tables summarize the number and percentages of reported incidents in two selected categories for 1988 and 1989. Table one summarizes reports of communication problems in which controller actions led to violation of aircraft separation standards. Table two summarizes reports of communication problems which involved pilot infractions of FAA regulations. An appendix to this testimony provides a description and example of each communication problem area.

Now I'd like to turn to some of the aviation human factors research we are conducting.

Starting in 1989 NASA increased human factors research directed at aviation safety and automation with the primary objective of improving the safety of the National Airspace System through development and integration of automation technologies for aircraft crews and air traffic controllers.

This applied activity addresses three important and interlocking research issues: First, understanding and providing guidelines for effective and safe interfaces between humans and automation; second, developing the technology for intelligent, error-tolerant cockpits and ATC systems; and, third, providing effective cockpit/ATC integration. Information management is an essential part of this research and is focused on improving pilot/controller communications.

Increased cockpit automation is occurring due to the introduction of more flexible electronic displays and a variety of automated flight system management devices. These new systems provide the flight crew with the capability to fly optimum flight paths, to achieve maximum fuel economy, and to achieve precise airport arrival times. However, the air traffic management system does not permit full use of these capabilities. Less than 20 percent of all automated flights are completed as planned, due to revisions in ATC instructions, especially during descent and in terminal areas. The result is reduced fuel economy, increased work load, and, under some conditions, reduced attention to critical monitoring and management tasks.

NASA has pioneered the development of crew resource management and line-oriented flight training for airline crews. This research area deals with the way cockpit crews communicate with each other and with controllers. This research is conducted with the cooperation of the commercial airlines, the FAA, and others. Its impact lies in the training of crews to fully utilize all resources available to them in dealing with unplanned incidents and contingencies. Communications, as a resource, is emphasized.

CRM training has been adopted by numerous U.S. and international air carriers. During the past year, CRM training has been cited as a major factor in the heroic efforts aboard United Flight 232 at Sioux City when the aircraft suffered an uncontained failure of the number two engine, and the United Flight 811 out of Honolulu that lost a cargo door.

NASA's Ames Research Center is conducting fundamental research on routine air-ground communications. The program includes a field test to evaluate different words and phrases used in the communication of information to determine the actual information content provided by these words and phrases. This study will provide a database and recommendations to enhance future CRM training programs.

Also at NASA-Ames, investigators are determining better methods and techniques to provide pictorial displays of weather to the crew. A prototype of an automated weather data information system was viewed by your committee during your visit early this spring. It has been developed and evaluated in simulation, and fixed-base simulations of new display formats are being conducted in the Man-Vehicle Simulation Research Facility. Results are expected to be available in September of 1990.

Our researching program to develop technological solutions to communications problems within aviation operations is primarily based on the use of digital datalink. An effort at NASA Langley Research Center is focused on exchanges of digital messages between aircraft and ATC. The emphasis of this research is on airborne operational requirements.

Numerous fixed-base piloted simulations have been completed using airline flight crews, NASA test pilots, and Air Force transport pilots. A flight validation study of datalink technology using the NASA Transport Systems Research Vehicle is under way.

The objective of the flight tests are to compare current voice communications with digital information transfer during full mission flight scenarios typical of commercial airline transport operations. The flight tests are intended to validate results of previous fixed-base simulations and explore modified display formats and procedures.

Specific areas of emphasis include: Crew acceptance of perceived work load, relative communication response time, operations with an advanced datalink/crew interface, and the practicality of single-action pilot entry of messages into aircraft subsystems.

Initial data tends to validate the earlier fixed-based simulation results. Subject pilots reported very favorably on the features embedded in this advanced interface concept. Final data analysis will be available in the fall of 1990.

To summarize the results of our datalink research to date, we can say: That overall flight deck work load can be reduced, with automated entry of data into flight management systems; that significant reductions in datalink communications errors were measured as compared to conventional voice radio communications; that strategic, routine, and tactical weather information are all good candidates for information; that both current display units and dedicated displays are viable interfaces; synthetic speech of messages, touch panel displays, and yoke-mounted reply switches are all useful; and, finally, a mechanistic or equipment-centered approach to communications problems is not a solution. Appropriate use of human capabilities and proper use of technology by crews and controller are necessary.

We have also initiated a study with the Douglas Aircraft Company to assess the viability of retrofit concepts to permit current commercial transport aircraft to operate in the National Airspace System with the evolving aircraft/datalink systems. This will include an analysis of the integration of controls, displays, and operating procedures to support the datalink function. This study will be completed in May, 1991.

To further enhance the safety and capacity of the National Airspace System we have strengthened our cooperation with the FAA. An agreement between the FAA and NASA was signed by the respective administrators in January, 1990, which formally reconstituted the FAA/NASA Coordinating Committee and outlined a top-level framework for cooperation. This framework is composed of six major areas of focus: human factors, severe weather, environmental compatibility, cockpit/air traffic control integration, and airworthiness and program support.

The FAA, with the cooperation of NASA, is developing a national plan for aviation human factors research in response to the Aviation Safety Research Act of 1988. The national plan builds on NASA's fundamental and applied human factors research activities.

In conclusion, the ASRS database provides evidence of numerous communication problems within aviation operations. We have strengthened our relationships with the FAA and will cooperatively address these problems through our fundamental and applied human factors research activities.

Finally, I believe that a continued emphasis on understanding aviation communication problems and continuation of fundamental and focused research are the paths to successfully dealing with the cockpit/controller communications.

Thank you, Mr. Chairman. That completes my prepared testimony. I would be pleased to answer any questions.

Mr. **Oberstar**. Thank you very much, Doctor Graeber. That was very, very helpful and insightful testimony.

Our next testimony is from Mr. Newman at the ICAO—our U.S. representative to ICAO.

TESTIMONY OF DON M. NEWMAN, U.S. REPRESENTATIVE, INTERNATIONAL CIVIL AVIATION ORGANIZATION

Mr. **Newman**. Thank you, Mr. Chairman.

I was delighted to hear that you had visited your son at Notre Dame over the weekend. I hope that you breathed deeply out there at South Bend, Indiana, because that is God's air out there and my home town. [Laughter.]

Mr. Chairman and members of the Subcommittee on Aviation, you are to be complimented for holding this hearing on pilot/air traffic controller ATC communications issues. The transmission of information from ground to air and air to ground is critical. The problems encountered in communications difficulties between pilots and controllers can be very, very serious. It can be complicated further when the English used is the second language to the user.

The International Civil Aviation Organization—ICAO—was developed after World War II to enhance international civil aviation's safety and security. Today, 163 countries belong to ICAO, which is located in Montreal, Canada. English was adopted as the language to be used on international flights and controls; however, it should be kept in mind that local controllers and local pilots use their own native language almost exclusively outside of those dealing with the international flights.

What this means is that most foreign flights arriving in the USA are long-distance ones. Only a few of them originate in English-speaking countries. Things can get complicated if the crews are fatigued, the air traffic control environment is stressed, and flight conditions are adverse.

As a current commercial pilot with 47 years of experience with a multi-engine and instrument rating, I can say that you can have English as a primary language and still get confused.

When the pressure builds up and the interference is high on the radio transmissions due to atmospheric or man-made conditions, it can be a challenge to communicate clearly and concisely even in English. But clear and consistent terminology is what is required in today's aviation communications. The Nation's major hubs, because of capacity pressure, demand clear and concise communications.

All of the pilots flying outside of the USA comply with ICAO ATC and communications standards that are accepted and applied all over the world, and this includes American pilots who, of course, encounter certain differences in the quality of the English spoken. But when foreign crews arrive in the USA, they are confronted with a non-ICAO ATC environment.

In spite of this, the records and the reports do not include many incidences/accidents of pilot/controller confusion because English is a second language. Some of this is undoubtedly due to the fact that records are sparse on this problem. In approximately the last two decades in which over 14,000 incidents/accidents have been filed with ICAO, only a few have been attributed directly to the use of English as a second language.

Even though, from personal experience, I believe the record of aircraft incidences/accidents attributable to English as a second language should be higher than recorded, there may be an explanation.

First, aircraft incidences/accidents are not categorized in ICAO on the basis of communication problems generally. Secondly, many countries keep poor records, and in some, such records are nonexistent. Also, some refuse to provide such information. Thirdly, the largest factor in aircraft incidents/accidents has historically been attributable to pilot error which, in the final analysis, may or may not be due to problems encountered because English is a second language.

Inasmuch as we do not have much factual evidence, let me share some anecdotal evidence:

On 11/15/78, a twin engine Cessna 310 in a European environment on a VFR flight was diverted from one airport to another because of poor weather. The pilot was unfamiliar with the area, and, because of language problems, did not understand the ATC instructions. During a low-level VFR transit between two airfields, he maintained the last heading and altitude from ATC. The aircraft flew into a cloud-covered hill and all three on board were killed.

On 3/29/85, a Boeing 727-200 with 152 people on board struck a 26-foot tall light standard 2,640 feet beyond the end of runway 23-Right in Mexico City. The aircraft continued uneventfully on to Dallas, Texas. The incident was precipitated because the ATC clearance was not understood and the aircraft made an intersection take-off with the usable runway reduced by 2,800 feet at a density altitude of 10,000 feet mean sea level.

Also, on 5/28/85 a Boeing 747-SR collided with an MU-2S on the 18 runway in Tokyo, Japan, on its landing roll. Both the MU-2S' pilot and co-pilot believed they had received a take-off clearance to enter the runway, even though it had not been issued by the control tower.

My presentation has intentionally omitted any domestic pilot/controller confusion created by communications difficulties. Even though ICAO has some records of these U.S. incidences/accidents, the FAA records are more complete and comprehensive.

In the final analysis, there are problems in communications involving pilots and controllers for whom English is a second language. However, ICAO does not maintain the records that would indicate its magnitude. ICAO records of approximately the last two decades indicate only a few of the over 14,000 incidents/accidents recorded are attributable directly to the use of English as a second language; pilots and controllers who deal internationally would intuitively say that there are more.

Mr. Chairman, I appreciate this opportunity to share my concerns over this issue with you and the committee, and I will be happy to respond to questions either here or through correspondence. Thank you.

Mr. OBERSTAR. Thank you very much. I appreciate all the testimony delivered by the panel and the effort that went into developing it. They were very, very thoughtful presentations of a subject that has very many aspects.

Mr. Newman, let me begin with your comments, because I think you touch on the English as second language issue in a way that shows some real insight into that problem.

I am disappointed, frankly, that the record keeping is not more specific and more thoughtful about that subject because it isn't very useful to say "pilot error." There are many kinds of pilot error, and you have to get down to some specifics here, as you have suggested. Pilot error may suggest to the lay person that the pilot didn't know what he was doing. That's not the case technically. He may not have understood, as you were pointing out.

We already have large numbers of nationalities in the airspace, as I remarked in my opening comments. With what has happened in Eastern Europe, we will soon have a whole new set of accents in the air, and what are air traffic controllers in the U.S. and England and elsewhere going to do when they hear those rich Slavic tones, "Ve are entering airspace, vondering vhere ve are supposed to land," when you are hearing those heavy Slavic accents and having great difficulty understanding them in English?

And, Mr. Kern, in your comments you said that, in polling controllers, English as a second language was not a significant problem because they pay particular attention. I'm just not convinced that that is the case. I really think that language usage, accents, diction, and clarity of expression are, indeed, a problem. I have heard controllers say so and I have heard pilots say that.

Mr. Newman, you have given that some thought. Have you some suggestions as to how to address that aspect of this communication issue?

Mr. **Newman**. Let me share a personal insight that may or may not be objective, but it is very subjective. From the limited opportunities I have had personally to go into environments where the controllers do not speak English but will transform their foreign tongue into English for my benefit because they are in an environment where the international use of English is used, it helps me immensely when they slow the cadence down, even though they speak with an accent.

Another thing that helps me is a courteous greeting that kind of welcomes me into the environment so I don't feel like I am an intruder into Montreal when I go in and the controllers are speaking French, by and large, to everybody else in the environment and I'm listening very critically trying to pick out what is going on.

I'll call in, and if they answer me they'll say, "Good morning 9 Mike November," or "Good afternoon, 9 Mike November." Immediately the receptivity goes up.

I think if there is a way that we could imbue more courtesy into that initial transmission and reception that would go a long way toward understanding.

Now, that kind of ignores the kinds of hustle and bustle, the adverse weather conditions that may be intruding on that ability to kind of give it a slow cadence and welcome you hospitably, but it would seem to me that it would go a long way generally to start that conversation with a kind of openness that may or may not be present.

Mr. **Oberstar**. That's a very good through, indeed.

You touched in those remarks about another point, and that is that you enter Canadian airspace, for example, in the Province of Quebec, and controllers may be speaking to everybody in French.

Mr. **Newman**. They are speaking in French to everybody except international flights.

Mr. **Oberstar**. And now when you travel in Europe and you bounce from one airspace to another aren't you encountering somewhat the same problems?

Mr. **Newman**. There are approximately 32 different controllers in the European region, and all of those accents are mixed in that milieu.

Mr. **Oberstar**. So it is important for a pilot to hear the traffic that is going on around him, isn't it?

Mr. **Newman**. Absolutely.

Mr. **Oberstar**. And if you are in an airspace where the pilot/controller communication is in another language that you don't understand, you are at somewhat of a disadvantage and somewhat of an uncertainty and somewhat at a risk?

Mr. **Newman**. It elevates the anxiety level.

Mr. **Oberstar**. What is ICAO doing about that? What are they saying about this?

Mr. **Newman**. Well, we have developed English as the international language, as you know, at ICAO. The subject you broached, though, even gives me more pause and concern—opening up the Balkans—because it is my understanding, just in conversation, that only three of the Russian controllers speak English, and if we are going to open up that frontier aeronautically we've got a real problem.

Mr. **Oberstar**. Well, there is a huge airshed over Poland, Czechoslovakia, Hungary, Bulgaria, and Romania that will be available now to relieve some of the congestion over Western Europe in those limited airspaces that have heavy military reservation and narrow civilian corridors. Europe has one-fourth the airspace of the United States, twice as many air traffic control centers and route centers as we have in the U.S., a plethora of languages, and then you start getting those Polish accents and Czech accents and Russian, and then we are going to have real difficulty.

What about pilot training and controller training in phonetics and diction, just dealing on this one sphere, without getting into all the other complexities that you and the other witnesses have touched on? What focus has there been in ICAO on dealing with that aspect of it?

Mr. **Newman**. I'd really like to defer to the FAA, if I may, on that. They work on that. It is my understanding that they have classes that underwrite the cost and support the teaching of English to foreigners—both controllers and pilots.

Mr. **Oberstar**. I'll come to FAA in a moment. I just wanted to know what effort there is in ICAO on that subject.

Mr. **Newman**. Well, frankly, I couldn't answer the question here, but I'd like to follow up with correspondence, if I may, and give you some insights.

Mr. **Oberstar**. Please do. Thank you.

[Correspondence referred to by Mr. Newman retained in subcommittee files.]

Mr. **Oberstar**. Mr. Kern, the NTSB has made numbers of recommendations and has testified in their presentation that the FAA has, for various reasons, not adopted these recommendations. Why not?

Mr. **Kern**. Well, I'm not sure exactly what recommendations the chairman is talking about, but I would like to clear one thing up. The survey we had the other day of air traffic controllers was one single datapoint that was rather informally gathered and is not an official FAA position. As I said in my statement, we clearly recognize the seriousness of this issue and the potential that this issue has and the impact that it may have on aviation safety.

I think that the FAA's response in the area of establishing our human factors program that includes, in almost every component of the human factors program, effective communications, including the language part of that, to be very responsive to NTSB's recommendations.

Mr. **OBERSTAR**. Well, on page eight of the NTSB testimony it says, "We issued eight safety recommendations to the FAA on August 11, 1989, with respect to the investigation of an operation error at the New York TRACON." It doesn't indicate that there was FAA response. And then, further down on the page, "In December of last year the Board issued 11 safety recommendations and FAA said, "We've taken previous efforts to address the issue and no need existed," says the NTSB "to issue a general notice at that time."

That is all too frequent a refrain from the FAA, I must say, in response to NTSB recommendations. I'd like to know what previous efforts were taken to address the recommendations. You don't have those at your fingertips. You could submit that in writing. I'd like to have that.

Mr. **KERN**. Sure.

[The information received from Mr. Kern follows:]

PILOT/CONTROLLER COMMUNICATION

These safety recommendations were issued as a result of the Board's investigation of an operational error at the New York Terminal Radar Approach Control (TRACON). The operational error involved Trans World Airlines Flight 843, a Boeing 747, inbound to the John F. Kennedy (JFK) International Airport, and Pan American World Airways Flight 537, a Boeing 727, inbound to the LaGuardia Airport. At the time of the incident, both flights were at their assigned altitudes of 3,000 feet mean sea level. In-flight visibility was reported as 3 to 4 miles.

The FAA provided its initial response to the Safety Board on November 3, 1989. The Safety Board has not yet responded to the FAA. Listed below is the recommendation and the FAA's response:

A-89-83. Develop software programs to identify duplicate and similar flight call signs that are in simultaneous use or are likely to be in simultaneous use in an individual sector or normally-combined sectors of both en route and terminal facilities.

> FAA Comment. The FAA analyzed the modification of the current software programs to alert the controller to similar call signs. This analysis revealed that the amount of identification checks that would be required to eliminate all possible conflicts would place too much of a strain on the memory capability. The amount of core memory and processing time required would severely strain the FAA's current resources.
>
> As an alternative solution, the Mode S Data Link will eliminate many of the routine air traffic control verbal contacts currently required between controllers and pilots, thus providing additional time for controllers to visually scan available flight data for, among other things, similar call signs. The Mode S Data Link concept is currently under development and will be ready for limited operational use in 1992 and fully operational in 1995.
>
> The FAA believes that this alternate solution will satisfy the intent of this safety recommendation.

A-89-84. Amend handbook 7110.65, "Air Traffic Control," to require controllers to notify supervisors when duplicate, phonetically similar, or potentially confusing flight call signs occur simultaneously on the same voice communication frequency.

> FAA Comment. The FAA does not plan to revise Handbook 7110.65 as requested in this safety recommendation because it does not view this as a systemic problem. The FAA believes that the procedures outlined in

Handbook 7110.65F, paragraph 2-87, are adequate. This paragraph states that the air traffic controller is to notify each pilot concerned when communicating with aircraft having similar sounding identifications and provides specific examples for the air traffic controllers' use. The FAA believes that as a general practice the air traffic controllers are currently notifying their supervisors when similar sounding call signs occur. To reinforce this action, the FAA will publish an article in the Air Traffic Bulletin to remind the air traffic controllers of the importance of notifying their supervisor of similar sounding call signs. The FAA believes that the Air Traffic Bulletin is a more appropriate vehicle because it requires a mandatory briefing of each air traffic controller. Once the briefing has been given, an annotation is placed in the air traffic controller's training folder.

The FAA will provide the Board with a copy of the bulletin as soon as it is issued.

A-89-85. Issue a General Notice (GENOT) directing that all air traffic control supervisory personnel review the procedures contained in the Facility Operation and Administration handbook, 7210.3I, regarding the reporting of duplicate, phonetically similar, or hard-to-distinguish flight call signs. The GENOT should also emphasize the importance of and assign a higher priority to the reporting of all known instances.

FAA Comment. The FAA does not believe that a General Notice is the appropriate avenue to remind air traffic control supervisory personnel to review the procedures contained in the Facility Operation and Administration handbook regarding the reporting of duplicate or phonetically similar call signs. The air traffic managers and supervisors are currently required to be familiar with this handbook, and paragraph 210 is very specific about the notification process to be used for aircraft identification problems. These instructions include reporting duplicate, phonetically similar, or hard-to-distinguish call signs. The FAA will publish an article in the Air Traffic Bulletin to address this issue.

The FAA will provide the Board with a copy of the bulletin as soon as it is issued.

A-89-86. Revise visual acuity standards for air traffic controllers to include testing at specific distance ranges dictated by the tasks to be performed.

FAA Comment. The Alaskan Regional Flight Surgeon, who is a board-certified ophthalmologist, recently performed an evaluation of work distances for air traffic control specialist positions at some of the center and TRACON facilities. The evaluation revealed that virtually all work is performed within a 15- to 32-inch distance. All controllers have a radar screen, upper panels of information, strip locations, and maps, etc., within the distances noted above. The chairs are mobile, and considerable variation in position and flexibility in work distance are available. There is no specific distance that is either required or optimal for the working distance of the air traffic control specialist. It is important to note that nearly all near vision objects at the air traffic control specialist position are of a larger size, and the image size and intensity on the screens on some radar terminals are controllable by the individual working the position. Thus, considerable size enhancement is possible.

The FAA is currently reviewing all air traffic control specialists' medical standards, including those pertaining to visual acuity. Although testing at each specific distance suggested by an air traffic control specialist task may not be feasible, it is possible that an "intermediate" test distance might be included in the proposed standards.

The FAA will keep the Board apprised of its progress on this safety recommendation.

A-89-87. Require that any visual correction for an air traffic controller be accomplished in a manner that eliminates the need to change, add, or remove various corrective lenses while performing air traffic control duties.

FAA Comment. The FAA does not agree with this safety recommendation. It is doubtful that refractive error corrections for every working distance associated with the air traffic control specialists' duties can be directly incorporated into one pair of continually worn spectacles for every air traffic control specialist requiring such correction. Yet this would be required for many individuals if change of lenses during work is to be avoided. The FAA believes that an air traffic control specialist should have the option to select the type of corrective lenses that he/she requires and is most comfortable with. This would allow use of separate near and distance spectacles, contact lenses for distance with the addition of spectacles for near vision, unifocal contact lenses that correct for both near and distance vision, bifocal spectacles, or continuously variable focus spectacles. If the air traffic control specialist requires correction only for near vision, spectacles, half-spectacles, or bifocal spectacles without power in the distance portion may be used. Contact lenses that correct only near vision and bifocal contact lenses are not permitted by the FAA. The use of contact lenses that correct for near vision in one eye and for distance vision in the other are also not permitted by the FAA.

The FAA believes that adoption of this safety recommendation would preclude many of these options and may force individuals to use unfamiliar or uncomfortable correction devices while performing air traffic control specialist duties.

The FAA plans no further action on this safety recommendation.

A-89-88. Require a controller to wear visual corrective lenses for specific distance ranges dictated by the tasks performed if visual corrective lenses are used to meet the standards for medical certification.

FAA Comment. The FAA does not agree with this safety recommendation. An air traffic control specialist is expected to be proficient in using his/her chosen method of visual correction while controlling air traffic, and currently must wear any correction required for distance. A regulatory requirement such as the one requested by this safety recommendation would significantly and unnecessarily limit the choice of visual aid. The FAA does not believe that there are significant operational problems occurring with the use of corrective lenses.

The FAA plans no further action on this safety recommendation.

A-89-89. Establish recurrent procedures to notify first-line supervisors which controllers under their supervision are required to wear corrective lenses during the performance of air traffic control duties.

FAA Comment. The FAA agrees with the intent of this safety recommendation and has initiated a study to determine the best approach to implementing these procedures.

The FAA will keep the Board apprised of its progress on this safety recommendation.

A-89-90. Review present visual acuity standards for pilot medical certificates, especially those for the first-class medical certificate, to determine whether regulations pertaining to the following areas should be revised or added: acuity for near vision; examination at intermediate-distance range; correction in a manner that would eliminate the need to change, add, or remove various lenses while exercising the privileges of the airman certificate; and the wearing of corrective lenses while exercising the privileges of the airman certificate.

FAA Comment. The FAA conducted a comprehensive review of the medical standards and has received recommended standards for all visual parameters from the American Medical Association. The FAA is presently considering a revision to the medical standards contained in 14 CFR Part 67.

The FAA will provide the Board with a copy of any document that may be issued.

U.S. Department
of Transportation
**Federal Aviation
Administration**

Office of the Administrator

800 Independence Ave., S.W.
Washington, D.C. 20591

NOV 3 1989

The Honorable James L. Kolstad
Acting Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, DC 20594

Dear Mr. Kolstad:

This is in response to Safety Recommendations A-89-83 through -90 issued by the Board on August 11, 1989. These safety recommendations were issued as a result of the Board's investigation of an operational error at the New York Terminal Radar Approach Control (TRACON). The operational error involved Trans World Airlines Flight 843, a Boeing 747, inbound to the John F. Kennedy (JFK) International Airport, and Pan American World Airways Flight 537, a Boeing 727, inbound to the LaGuardia Airport. At the time of the incident, both flights were at their assigned altitudes of 3,000 feet mean sea level. In-flight visibility was reported as 3 to 4 miles.

A-89-83. Develop software programs to identify duplicate and similar flight call signs that are in simultaneous use or are likely to be in simultaneous use in an individual sector or normally-combined sectors of both en route and terminal facilities.

FAA Comment. The Federal Aviation Administration (FAA) analyzed the modification of the current software programs to alert the controller to similar call signs. This analysis revealed that the amount of identification checks that would be required to eliminate all possible conflicts would place too much of a strain on the memory capability. The amount of core memory and processing time required would severely strain the FAA's current resources.

As an alternative solution, the Mode S Data Link will eliminate many of the routine air traffic control verbal contacts currently required between controllers and pilots, thus providing additional time for controllers to visually scan available flight data for, among other things, similar call signs. The Mode S Data Link concept is currently under development and will be ready for limited operational use in 1992 and fully operational in 1995.

I believe that this alternate solution will satisfy the intent of this safety recommendation. I will keep the Board apprised of the FAA's progress on this safety recommendation.

A-89-84. Amend handbook 7110.65, "Air Traffic Control," to require controllers to notify supervisors when duplicate, phonetically similar, or potentially confusing flight call signs occur simultaneously on the same voice communication frequency.

FAA Comment. The FAA does not plan to revise Handbook 7110.65 as requested in this safety recommendation because it does not view this as a systemic problem. The FAA believes that the procedures outlined in Handbook 7110.65F, paragraph 2-87, are adequate. This paragraph states that the air traffic controller is to notify each pilot concerned when communicating with aircraft having similar sounding identifications and provides specific examples for the air traffic controllers' use. The FAA believes that as a general practice the air traffic controllers are currently notifying their supervisors when similar sounding call signs occur. To reinforce this action, the FAA will publish an article in the Air Traffic Bulletin to remind the air traffic controllers of the importance of notifying their supervisor of similar sounding call signs. The FAA believes that the Air Traffic Bulletin is a more appropriate vehicle because it requires a mandatory briefing of each air traffic controller. Once the briefing has been given, an annotation is placed in the air traffic controller's training folder.

I will provide the Board with a copy of the bulletin as soon as it is issued.

A-89-85. Issue a General Notice (GENOT) directing that all air traffic control supervisory personnel review the procedures contained in the Facility Operation and Administration handbook, 7210.3I, regarding the reporting of duplicate, phonetically similar, or hard-to-distinguish flight call signs. The GENOT should also emphasize the importance of and assign a higher priority to the reporting of all known instances.

FAA Comment. The FAA does not believe that a General Notice is the appropriate avenue to remind air traffic control supervisory personnel to review the procedures contained in the Facility Operation and Administration handbook regarding the reporting of duplicate or phonetically similar call signs. The air traffic managers and supervisors are currently required to be familiar with this handbook, and paragraph 210 is very specific about the notification process to be used for aircraft identification problems. These instructions include reporting duplicate, phonetically similar, or hard-to-distinguish call signs. The FAA will publish an article in the Air Traffic Bulletin to address this issue.

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A-89-86. Revise visual acuity standards for air traffic controllers to include testing at specific distance ranges dictated by the tasks to be performed.

FAA Comment. The Alaskan Regional Flight Surgeon, who is a board-certified ophthalmologist, recently performed an evaluation of work distances for air traffic control specialist positions at some of the center and TRACON facilities. The evaluation revealed that virtually all work is performed within a 15- to 32-inch distance. All controllers have a radar screen, upper panels of information, strip locations, and maps, etc., within the distances noted above. The chairs are mobile, and considerable variation in position and flexibility in work distance are available. There is no specific distance that is either required or optimal for the working distance of the air traffic control specialist. It is important to note that nearly all near vision objects at the air traffic control specialist position are of a larger size, and the image size and intensity on the screens on some radar terminals are controllable by the individual working the position. Thus, considerable size enhancement is possible.

The FAA is currently reviewing all air traffic control specialists' medical standards, including those pertaining to visual acuity. Although testing at each specific distance suggested by an air traffic control specialist task may not be feasible, it is possible that an "intermediate" test distance might be included in the proposed standards.

I will keep the Board apprised of the FAA's progress on this safety recommendation.

A-89-87. Require that any visual correction for an air traffic controller be accomplished in a manner that eliminates the need to change, add, or remove various corrective lenses while performing air traffic control duties.

FAA Comment. The FAA does not agree with this safety recommendation. It is doubtful that refractive error corrections for every working distance associated with the air traffic control specialists' duties can be directly incorporated into one pair of continually worn spectacles for every air traffic control specialist requiring such correction. Yet this would be required for many individuals if change of lenses during work is to be avoided. The FAA believes that an air traffic control specialist should have the option to select the type of corrective lenses that he/she requires and is most comfortable with. This would allow use of separate near and distance spectacles, contact lenses for distance with the addition of spectacles for near vision, unifocal contact lenses that correct for both near and distance vision, bifocal spectacles, or continuously variable focus spectacles. If the air traffic control specialist requires correction only for near vision, spectacles, half-spectacles, or bifocal spectacles without power in the distance portion may be used. Contact lenses that correct only near vision and bifocal contact lenses are not permitted by the FAA. The use of contact lenses that correct for near vision in one eye and for distance vision in the other are also not permitted by the FAA.

The FAA believes that adoption of this safety recommendation would preclude many of these options and may force individuals to use unfamiliar or uncomfortable correction devices while performing air traffic control specialist duties.

I plan no further action on this safety recommendation.

A-89-88. Require a controller to wear visual corrective lenses for specific distance ranges dictated by the tasks performed if visual corrective lenses are used to meet the standards for medical certification.

FAA Comment. The FAA does not agree with this safety recommendation. An air traffic control specialist is expected to be proficient in using his/her chosen method of visual correction while controlling air traffic, and currently must wear any correction required for distance. A regulatory requirement such as the one requested by this safety recommendation would significantly and unnecessarily limit the choice of visual aid. The FAA does not believe that there are significant operational problems occurring with the use of corrective lenses.

I plan no further action on this safety recommendation.

A-89-89. Establish recurrent procedures to notify first-line supervisors which controllers under their supervision are required to wear corrective lenses during the performance of air traffic control duties.

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I will keep the Board apprised of the FAA's progress on this safety recommendation.

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FAA Comment. The FAA conducted a comprehensive review of the medical standards and has received recommended standards for all visual parameters from the American Medical Association. The FAA is presently considering a revision to the medical standards contained in 14 CFR Part 67.

I will provide the Board with a copy of any document that may be issued.

Sincerely,

James B. Busey
Administrator

National Transportation Safety Board
Washington, D.C. 20594
Safety Recommendation

Date: August 11, 1989
In reply refer to: A-89-83 through -90

Honorable James B. Busey
Administrator
Federal Aviation Administration
Washington, D.C. 20591

On August 9, 1987, an operational error occurred at the New York Terminal Radar Approach Control (TRACON) that involved Trans World Airlines flight 843 (TW843), a Boeing 747, inbound to the John F. Kennedy (JFK) International Airport and Pan American World Airways flight 537 (PA537), a Boeing 727, inbound to the LaGuardia Airport. At the time of the incident, both flights were at their assigned altitudes of 3,000 feet mean sea level (msl). In-flight visibility was reported as 3 to 4 miles.

Prior to the incident, TW843 was issued vectors in preparation for the landing sequence at JFK. This flight was followed by another company flight, TW834, a Boeing 727 also inbound to JFK. The arrival controller issued a turn that he had intended for TW843; however, when the instruction was verbalized, he addressed the airplane as "TW834 Heavy."[1] As a result, the flightcrew of TW834 complied with the turn instruction. The flight for which the turn was intended (TW843) continued straight ahead and entered the airspace of an adjacent sector where a loss of standard separation occurred with PA537: the controller for TW843 and the controller for PA537 both issued instructions to climb from 3,000 to 4,000 feet. The flightcrew of PA537 reported to the LaGuardia arrival controller, "We went underneath him," and later said, "OK, looks like we were maybe 6[00] to 700 feet below him." Both flights were returned on course without further incident.

The controller who made the error said that he had confused the similar flight call signs and issued instructions to one flight that were actually intended for another. He had been employed by the Federal Aviation Administration (FAA) as a controller since 1958, working at Newark Tower for a "few months" and then as a radar approach controller at facilities associated with JFK Airport. He reported that this operational error was his first in 20 years.

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[1] The Boeing 747 is categorized as a heavy jet, which is capable of takeoff weights of 300,000 pounds or more. During radio communications, flightcrews and air traffic controllers will add the word "heavy" after the company prefix and trip number. The word alerts controllers and pilots of other airplanes that additional separation requirements must be considered because of possible wake turbulence while airborne.

During the investigation, the FAA reported that it was conducting an internal study on the problem of duplicate flight call signs. In January 1988, the Safety Programs Division of the FAA Office of Aviation Safety completed the study, "Duplicate Flight Numbers at Major U.S. Airports." The study concluded that among the 12 airports examined, there were 951 occurrences of flights using the same number operating within 2 hours of each other. Of these occurrences, there were 310 flights using the same number within 30 minutes of each other. The study contained no recommendations, was limited to duplicate flight numbers, and did not address the issue of similar flight numbers.

The FAA handbook, "Facility Operation and Administration," instructs air traffic control facilities to contact the Air Transport Association (ATA) or, in the case of nonmembers, the operator directly, when duplicate, phonetically similar, or hard-to-distinguish flight call signs are used so that changes may be made. This handbook is written for supervisors and other facility administration personnel. Operational procedures for controllers are contained in handbook 7110.65E, "Air Traffic Control." That handbook, however, does not contain instructions for controllers concerning the reporting of duplicate or similar call signs.

Within a few minutes after this incident occurred, the same controller again confused two other flights, Clipper 568 (PA568) and Clipper 558 (PA558); however, the confusion did not result in a loss of separation. Facility supervisors and training department personnel, and regional personnel did not report the second instance of phonetically similar flight call signs to the ATA until after the Safety Board raised the issue with the FAA. The ATA was notified of this additional confusion of call signs about 3 weeks after it occurred.

The Safety Board believes that these events highlight the inadequate priority associated with the reporting of similar-sounding flight call signs. The incidents also illustrate the need for the FAA to develop software programs that will identify potentially confusing or duplicate call signs in both air route traffic control centers and terminal facilities. In the interim, handbook 7110.65, "Air Traffic Control," should be amended to instruct controllers to notify their supervisors when duplicate, phonetically similar, or hard-to-distinguish call signs are used.

The investigation of these incidents also revealed deficiencies related to the visual acuity standards and the corrected vision requirements for controllers. The controller involved in the incidents stated that he had difficulty contacting the LaGuardia controller by dialing a three-digit indirect access code on the intraphone communication system in the facility. He had a problem obtaining the correct code and believed more time was required to make contact than was necessary. He said that before the recent change in codes, contact was made by pushing a single button. A list containing indirect access codes for New York TRACON was posted on the final vector position of the Kennedy area, about 3 feet from the controller. The list contained a breakdown of the indirect access codes for various positions within the five areas of the TRACON. The type size of the list was 11 characters per inch. The Safety Board believes this type size was adequate and should not have posed a problem for the controller unless his vision was not distinct at that distance.

A review of the controller's medical records disclosed that he held a second-class medical certificate dated February 26, 1987, with the limitation, "Holder shall possess correcting glasses for near vision while exercising the privileges of his airman certificate." Records indicated that the controller's uncorrected near vision was 20/70 at the time of the examination. Another examination in early 1988 indicated that his uncorrected near vision was 20/100. The controller said that his eyeglasses were in his shirt pocket at the time the incidents occurred. A subsequent review of the FAA medical standards for air traffic controllers revealed no requirement to wear corrective glasses for either near vision or distant vision while performing their duties as controllers.

The present visual acuity standards for air traffic controllers state that both distant and near vision of 20/20 must be demonstrated. If corrective lenses are required to meet this standard, refractive error limits apply in which the prescription of the correction is accounted for. Diopters of spherical equivalent and cylinder are specified. These standards are contained in "ATCS (Air Traffic Control Specialist) Medical Standards," extracted from the Office of Personnel Management Handbook X-118 dated August 21, 1988. However, the Safety Board's experience has been that these standards are not applied consistently among FAA regions.

An air traffic controller is generally not issued a medical certificate unless the controller is also a pilot. Even if the controller is a pilot, he is still subject to the more stringent visual acuity standards for controllers. The controller who is a pilot receives either a first-class or second-class medical certificate, depending on the type of flying that the controller is engaged in. The controller who confused the call signs was also a pilot and had a second-class medical certificate.

First-class and second-class medical certificates for pilots require an uncorrected distant vision of 20/20 or better in each eye, or at least 20/100 in each eye corrected to 20/20 or better. Both certificates stipulate that the holder wear corrective lenses for distance while exercising the privileges of the airman certificate. A first-class medical certificate requires a near vision of 20/40 at a distance of 18 inches with each eye, with or without corrective lenses. A second-class medical certificate requires only that near vision demonstrate enough accommodation to read "official" aeronautical maps. Neither class of medical certificate requires that the holder wear corrective lenses for near vision while exercising the privileges of the airman certificate, only that the holder must have such lenses in possession.

The standards presently used for visual acuity address only near vision, normally determined at a distance of 12-14 inches, and distant vision, normally determined at 20 feet. Controllers' duties, however, are often performed under conditions where objects at other distances must be identified clearly. A radar controller, for example, usually works at a visual range of 2 1/2 to 3 feet, the distance of the radar display and flight strips from the controller's eyes. The radar controller has little need for corrected distant vision at 20 feet. However, a controller in a control tower cab would have different vision requirements: distant vision for sighting aircraft, intermediate vision for viewing a radar display, and near vision for reading documents.

The Safety Board is concerned about the adequacy of the present visual acuity standards and the present requirements relating to wearing corrective lenses. Using the present standards and requirements, the following situation could easily occur: Assume a radar controller has an uncorrected distant and near vision of 20/20. As the controller ages, he begins to experience difficulty seeing small print at close range, such as newspaper print and numbers in a telephone book. An eye examination reveals a deficiency in near vision, and the controller is told he must get corrective lenses. His doctor prescribes corrective lenses for near vision (about 12-14 inches), and the controller passes the medical examination using the lenses. To perform most of his duties, however, he does not need the lenses because he looks at objects that are about an arm's length away--about 2 1/2 to 3 feet. As the controller grows older, objects at arm's length--which include his radar screen--begin to blur. The lenses he wears when reading material at close range do not help him see material at arm's length. He continues eligibility to control traffic by wearing his corrective lenses to pass the near-vision portion of the annual eye examination. To perform his duties, however, the controller needed lenses to correct intermediate vision rather than lenses to correct near vision.

In the example cited, the controller had a normal aging condition called presbyopia. The condition, more fully described in medical literature, occurs with the loss of elasticity of the lens of the eye. It causes defective accommodation and inability to focus properly for near vision. As one ages, vision at middle distances may become blurry, and finally even objects at a distance may also be blurred. The Safety Board believes that the visual acuity standards should be tailored for the specific distance ranges dictated by the tasks to be performed and that controllers should be examined for all applicable ranges.

The Safety Board also believes that all corrections required to demonstrate 20/20 vision at all applicable distances should be present in the same pair of corrective lenses. A controller cannot perform duties safely while changing, adding, or removing various corrective lenses, or while not wearing a necessary correction. Because nearly all controllers wear headsets, and some of them have their headsets clipped to the frame of their eyeglasses, removal and replacement of corrective lenses may offer a frequent distraction to the task at hand. Any visual correction should be accomplished in a manner that eliminates the need to change, add, or remove various corrective lenses while performing air traffic control duties.

The Safety Board also sees little value in requiring that visual acuity be corrected without also requiring that the correction be worn. Therefore, the Safety Board believes that standards for air traffic controllers should require the controller to wear the corrective lenses prescribed for the distance ranges dictated by the tasks to be performed.

Normally, the air traffic control facility in which the controller is employed receives either a printed list of controllers who have passed medical examinations or a form for each controller indicating that the controller has received and passed a medical examination. The form states whether or not a controller had to wear corrective lenses to meet the visual acuity standards during the examination. The form is generally kept with the controller's training records. The Safety Board believes that first-line supervisors should be made aware on a continuing basis of controllers required to wear corrective lenses.

The visual acuity standards for pilots were not part of the investigation of the August 9, 1987, incident. The Safety Board notes, however, that the need for visual acuity at different ranges is applicable for pilots as well as for controllers. The Safety Board also notes that the corrected near vision demonstrated must be 20/40 for a pilot's first-class medical certificate but 20/20 for an air traffic controller. The Safety Board believes that the FAA should review the present visual acuity standards for pilot medical certificates to determine whether they should be revised.

Therefore, as a result of its investigation, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Develop software programs to identify duplicate and similar flight call signs that are in simultaneous use or are likely to be in simultaneous use in an individual sector or normally-combined sectors of both en route and terminal facilities. (Class II, Priority Action) (A-89-83)
>
> Amend handbook 7110.65, "Air Traffic Control," to require controllers to notify supervisors when duplicate, phonetically similar, or potentially confusing flight call signs occur simultaneously on the same voice communication frequency. (Class II, Priority Action) (A-89-84)
>
> Issue a General Notice (GENOT) directing that all air traffic control supervisory personnel review the procedures contained in the Facility Operation and Administration handbook, 7210.3I, regarding the reporting of duplicate, phoenetically similar, or hard-to-distinguish flight call signs. The GENOT should also emphasize the importance of and assign a higher priority to the reporting of all known instances. (Class II, Priority Action) (A-89-85)
>
> Revise visual acuity standards for air traffic controllers to include testing at specific distance ranges dictated by the tasks to be performed. (Class II, Priority Action)(A-89-86)
>
> Require that any visual correction for an air traffic controller be accomplished in a manner that eliminates the need to change, add, or remove various corrective lenses while performing air traffic control duties. (Class II, Priority action)(A-89-87)
>
> Require a controller to wear visual corrective lenses for specific distance ranges dictated by the tasks performed if visual corrective lenses are used to meet the standards for medical certification. (Class II, Priority Action)(A-89-88)

Establish recurrent procedures to notify first-line supervisors which controllers under their supervision are required to wear corrective lenses during the performance of air traffic control duties. (Class II, Priority Action)(A-89-89)

Review present visual acuity standards for pilot medical certificates, especially those for the first-class medical certificate, to determine whether regulations pertaining to the following areas should be revised or added: acuity for near vision; examination at intermediate-distance range; correction in a manner that would eliminate the need to change, add, or remove various lenses while exercising the privileges of the airman certificate; and the wearing of corrective lenses while exercising the privileges of the airman certificate. (Class II, Priority Action)(A-89-90)

KOLSTAD, Acting Chairman, BURNETT, LAUBER, NALL, and DICKINSON, Members, concurred in these recommendations.

For
By: James L. Kolstad
Acting Chairman

Mr. **Kern**. I'll ask Mr. Owens to comment on the details of that, but, as this committee knows, the FAA is, I think, still the most responsive agency or individual of any in government and industry toward positive responses to NTSB recommendations. I would hope in this case that if we didn't accept them that we have taken some kind of alternate satisfactory activity.

Let me ask Mr. Owens to further comment.

Mr. **Oberstar**. Mr. Owens.

Mr. **Owens**. I would certainly echo that comment. There is no question we implement the vast majority of recommendations. Many times a recommendation addresses a specific, singular problem. On closer examination, we sometimes form the opinion that the recommended solution would create other problems in peripheral areas.

Let me give you an example. I believe one of the recommendations was to require a pilot to read back a clearance where a "hold short of runway" instruction was given rather than just acknowledge the transmission.

At busy, complex airports, if that would become the practice you would find a considerable amount of congestion on the ground that, in fact, would start to derogate safety rather than to satisfy a safety problem. So in many cases it is that kind of analysis that leads us not to implement a recommendation or to come up with an alternative.

In the case of the GENOT, a GENOT is used as an alert kind of a bulletin. We feel that if you use it routinely you run the risk of it becoming so routine that people don't pay attention to it when it is out there. So many times we'll use other means of transmitting that, which was the case in this instance. We just didn't use the GENOT.

Mr. **Oberstar**. Well, I've gone beyond my self-imposed time limit of ten minutes, and I want to give others the opportunity to raise questions.

Before going on to other members, though, I want to compliment FAA on the Cockpit Resource Management program, on the Line Oriented Flight Financing Program, and the Advanced Qualification Program, and observe that had an effective and intensive cockpit resource management program been in effect six or seven years ago, we might not have had the Galaxy tragedy in 1985, because that was a clear case of failure of the cockpit members to operate as a team. They were all troubleshooting, they had no division of responsibility, and there was no one flying the aircraft when it crashed.

So that kind of effort and focusing on simulator training is very much to your credit, and I compliment FAA on it. I'll come back to focus on simulator training in pilot/controller communication later.

Mr. Boehlert.

Mr. **Boehlert**. Thank you, Mr. Chairman. I'd like to follow up in your line of questioning with Mr. Kelley and Mr. Kern.

Mr. Kelley, when the NTSB makes recommendations on safety to the FAA, can you sort of waltz us through this exercise? You make the recommendation—always in writing, I would assume—and then the FAA gets it. Is there a time frame within which they need to act? And do they respond to you? When they respond to you, if there is disagreement who settles the tie? Do we need arbitration here?

Mr. **Kelley**. Yes, sir, Congressman. You are probably familiar with documents which we refer to as "green sheets."

Mr. **Boehlert**. Right.

Mr. **Kelley**. These are a safety recommendation letter that is approved by the full Board and is addressed to the administrator of the FAA.

Mr. **Boehlert**. Are those public documents?

Mr. **Kelley**. Yes, sir. And the initial part of the recommendation letter will be narrative text providing facts, rationale, and analysis as to the Board's reason and conclusion for the need for corrective action—in other words, laying out what we hope is a compelling argument for the administrator to make change.

And then, at the end of the letter, we specifically list safety recommendations, and they have classifications that range from urgent to priority and longer term.

Mr. **Boehlert**. And are time frames involved with those? Urgent requires immediate attention?

Mr. **Kelley**. Yes, sir.

Mr. **Boehlert**. Can you give me some time frames?

Mr. **Kelley**. Urgent, we believe requires immediate attention and action on the part of FAA.

Mr. **Boehlert**. Could you get specific? Are we talking about hours, days, weeks?

Mr. **Kelley**. Well, we have a phrase at the Safety Board when we are considering and drafting an urgent safety recommendation that nobody goes home until we get this done and get it approved by the Board. That's the way we feel about it.

Mr. **Boehlert**. To go out to FAA?

Mr. **Kelley**. Yes, sir.

Mr. **Boehlert**. Now, how about the response? The urgent requires a response in what time frame?

Mr. **Kelley**. There is no specific time frame, Congressman. We would hope—and I believe the FAA receives these urgent recommendations with the same frame of mind. They bring to bear their total staff immediately and react to it——

Mr. **Boehlert**. Can I pause right here? Mr. Kern, when you get one of these urgents at FAA, how is it viewed within FAA? Is this something where you drop everything and address this one? And do we have a specific turn-around time? It seems to me that urgent, if I understand the language, is pretty important.

Mr. **Kern**. It is. In fact, the kinds of recommendations we are talking about now, with urgent classifications, I would say the FAA has generally always responded before we get the green sheet. If we have an engine failure, such as the United Airlines Sioux City Accident and other catastrophes, we work with the NTSB on the investigation. Airworthiness directives, other appropriate removal of engines from wings, and things like that, have usually happened about the time we get the urgent green sheet.

Mr. **Boehlert**. But is there a stated policy? And shouldn't there be one if there isn't?

Mr. KERN. The stated policy right now is a 90-day return time of our response back to the NTSB, but I can tell you the practice right now on an urgent is exactly the same: we keep the people there, we burn the midnight oil—and the weekend oil—until we get something done.

Mr. BOEHLERT. And do you, Mr. Kelley, speaking for NTSB, feel that the urgent recommendations are given the attention they warrant?

Mr. KELLEY. Yes, I do.

Mr. BOEHLERT. Did you say 90 days, Mr.——

Mr. KERN. I believe it is a 90-day response in the formality part of it. But, again——

Mr. KELLEY. As Mr. Kerns says, many times there is staff discussion during the development of safety recommendations, so the FAA is not blindsided when they receive this. In many cases they are fully aware that the Board is formulating urgent recommendation action and, as Mr. Kern said, many times they are either prepared to go out immediately or shortly after receiving it. So there is a constant dialogue between the two agencies.

Mr. BOEHLERT. But, if I am correct, there is no stated policy in black and white that gives a time frame for responding to a specific recommendation in the various categories?

Mr. KELLEY. There is a Congressional law that says the FAA must respond—and other modal administrations, not just the FAA——

Mr. BOEHLERT. True.

Mr. KELLEY [continuing]. In 90 days——

Mr. BOEHLERT. In 90 days?

Mr. KELLEY [continuing]. To the Board as to what their intent is with regard to specific safety recommendations.

Mr. BOEHLERT. Do you feel comfortable with that 90-day time frame for an urgent matter?

Mr. KELLEY. No, sir. No, sir. We would expect that the FAA would think—and I believe they do—exactly as the Board does, that an urgent recommendation is synonymous with a life-threatening situation that requires immediate corrective action.

Mr. BOEHLERT. Is there any need for a change in that 90-day period in the law?

Mr. KELLEY. I don't think there is any reason for concern that the FAA is not totally responsive to these types of recommendations.

Mr. BOEHLERT. Let's go beyond the urgent category. I believe you said there are four categories?

Mr. KELLEY. Yes, sir.

Mr. BOEHLERT. Do you track them all? They go to FAA. Some obviously take months, and I can understand that.

Mr. KELLEY. Generally we will get a response back from the FAA within 90 days, and they will list the recommendation and they will give us their view, whether they concur or they don't concur.

Mr. BOEHLERT. So there is never a case of stonewalling? You always get a response to a specific recommendation?

Mr. KELLEY. Yes, sir.

Mr. BOEHLERT. Now, to follow that through, when the response comes to the specific recommendation—and I would assume in most instances you agree with FAA's analysis; is that fair?

Mr. KELLEY. That's correct. I think our batting average in persuading the FAA to adopt our recommendations is somewhere in the low 80 percentile. In many cases the FAA may not agree with the precise corrective action that we recommend, but they offer an alternate solution.

Mr. BOEHLERT. Is there a consultation during this period?

Mr. KELLEY. Many times there is, Congressman. We meet at the staff level and there is clarification and there is detailed discussion between the staff.

Mr. BOEHLERT. Now, the point I'm driving to: in those limited cases where you don't agree with their response, then what?

Mr. KELLEY. Well, many times we will meet with the staff, first of all, and provide our compelling investigative information to try and turn them around. Sometimes we do, sometimes we don't. Many times we will write back and ask the FAA to reconsider, and we will put additional facts and analysis in this letter.

Ultimately there are cases where we both agree to disagree.

That will be a very factual presentation of how the FAA feels on those specific recommendations.

Mr. BOEHLERT. But then you get to the end of this process and able professionals disagree. My concern is: who acts as an arbitrator? Or do we just go on to the next thing? You may be right, and you may be wrong.

Mr. KELLEY. Well, one thing we do, Congressman, is, in that case where we ultimately arrive at a point where we disagree, the Safety Board has an organizational structure that evaluates every response received from the FAA and they classify the FAA's response, whether it is acceptable or it is unacceptable.

Now, in the subject case that a recommendation would be closed, unacceptable action on the part of the FAA. Now, if we go down the road and we have subsequent investigations in which the same issue is surfaced, we will now go back to our records and identify these recommendations and say, "Now, you didn't agree with us here. Here is another investigation with the same issue prevalent," and we will again try to provide a compelling argument to get them to adopt the corrective action.

Mr. BOEHLERT. When you get to this point where you have disagreement and it has been reviewed and everything and there is still a disagreement, is there any mechanism under which you are required to report to the committees of jurisdiction of the House and Senate?

Mr. KELLEY. I think, Congressman, if a recommendation was of such a substantial nature and the Board was unable to convince the FAA to adopt corrective action, I believe the chairman would be right up here talking to you.

Mr. BOEHLERT. Is there any instance in recent memory where that has occurred?

Mr. KELLEY. I don't believe there is any instance where the issue was life-threatening and the FAA was not in concurrence with us, Congressman.

Mr. Boehlert. And since we are dealing with such a small percentage of cases where there is obviously disagreement, I don't think it would add to the burden of our committee or NTSB to have some sort of requirement that that information be relayed to the committee for the review by the professional staff and those of us who have special responsibility.

Mr. Kelley. Yes, sir, Congressman. I might add—and I hope you have been briefed on this—Chairman Kolstad has recently established a procedure in which the Board will officially adopt the ten most-wanted safety recommendations that, in the members' views, constitute top priority for corrective action. Now, that is intermodal and it will include surface modes and aviation. And the Board intends to publicize the ten most-wanted safety recommendations, and hopefully the strategy will have an effect on the recipients of those recommendations, and the Board hopes that we will be able to use this as a compelling argument to get administrators on the surface and aviation side to implement certain corrective actions.

Mr. Boehlert. Thank you very much.

Mr. Oberstar. The gentleman from Texas, Mr. Laughlin.

Mr. Laughlin. Thank you, Mr. Chairman.

Mr. Kelley and Mr. Kern, I'd like to address this first question to both of you. The chairman and Mr. Boehlert both have asked you, but on page eight of Mr. Kelley's testimony he indicated that the NTSB had made recommendations to the FAA regarding a general notice to all controllers reminding them of the need to identify and correct communication errors, and the FAA responded that they saw no need to issue that as they had already made that type of general notice.

While the chronology is not here in the testimony relating to the September 5, 1989—and I can't tell whether it is the date of the crash or the date of the report—it appears that the FAA has taken a position that they issued that general notice before the crash that was being investigated, and, if so, it appears that their notice was not adequate.

I wonder, when these type of instances occur that the NTSB has made that kind of recommendation, FAA responds by saying, "We don't need to do it because we have already done it," and it certainly appears to me that it didn't do any good, how do you resolve that difference? I know this has been addressed to you by the chairman and Mr. Boehlert, but it is a concern to us that it appears here that you have walked away from it. What effort do you make to resolve that?

Mr. Kelley. Congressman, as I mentioned earlier, we do not accept a non-concurrence from the FAA point blank. The first thing that we do when we receive a response from the administrator that says they do not concur with the intent of this recommendation, more than likely we will schedule a staff meeting with FAA appropriate staff and Safety Board staff to make sure that the FAA fully understands what the Board recommendation encompasses and, if possible, to give them some more expanding information.

Mr. Laughlin. Did you do that in this instance where they told you there was no need to issue the general notice?

Mr. KELLEY. We did not, Congressman. The letter from the administrator, which the Board has not evaluated—I'm just looking at the letter from the administrator. It was dated February 23, 1990. So it is——

Mr. LAUGHLIN. What was the date of that?

Mr. KELLEY. February 23, 1990.

Mr. LAUGHLIN. That's almost 90 days after the December 5th report, and now we are another almost 90 days. You're telling me nothing has happened?

Mr. KELLEY. We have scheduled meetings with FAA staff to discuss this response, Congressman.

Mr. LAUGHLIN. Well, after that meeting would you give us a written report on how you have resolved this situation of no need for a general notice?

Mr. KELLEY. Yes, sir.

Mr. LAUGHLIN. Thank you.

Mr. Newman, I certainly appreciated your comments when you talked about speech patterns and slowness and courteous responses by the air traffic controllers. Coming from the part of the country that has no accent——

[Laughter.]

Mr. LAUGHLIN [continuing]. I have problems sometimes hearing people from these parts of the country who have accents. And when you have someone that starts off their conversation in a courteous manner and is speaking slowly it certainly helps facilitate the communication. I had that experience also babbling a little bit in Spanish. I find that if those who have a different language can slow up their speech patterns, it certainly helps.

I'm wondering what actions ICAO has taken to address this courteous, slow approach to the speech patterns with the traffic controllers. I point out to you that recently—and it may be for some period of time—the Air Line Pilots Association indicates that foreign flight crews have difficulties understanding American English and machine-gun-like delivery. They have also indicated that the FAA air traffic controllers depart from or have been exempted from some of the ICAO standards. Could you respond to this? And could you also indicate why the FAA would want to exempt from internationally agreed-up standards?

Mr. NEWMAN. The last question first, sir. The difference between FAA and ICAO standards probably started because the United States is such a leader in aviation, that we were so far ahead of the rest of the world that we developed our own standards which we felt were not only adequate but that were very safe and efficient.

The deviations, I might add, are fairly small, given the broad array of directives that are issued between controllers and pilots and the response from pilots to controllers.

The most notable exception is the one "taxi into position." In the United States, by and large, that means "taxi into position on the runway and hold." ICAO standards would indicate that means to taxi into position up to the runway, staying on the taxiway, and you do not take the runway.

That has created some confusion when ICAO pilots are in this environment. But, you see, the confusion would auger toward more safety in the sense that they would not go out onto the runway and expose themselves to landing traffic or traffic that was taking off from an intersection runway.

So that deviation—which, in my limited investigation, is probably the most dramatic difference between U.S. standards and ICAO standards—would auger not toward more exposure to risk, but probably to even less exposure to risk.

That's just one illustration. There are others that I'd have to do some research and get back to you on.

The differences, in my opinion, are fairly small between ICAO standards and FAA standards. And it is not unique. Foreign countries will ask for exemption from ICAO standards for different reasons. It will usually be the addition of a word, or maybe two or three, or a deletion of a word in the directive.

Mr. LAUGHLIN. Well, in your example of taxiing on the runway language being a deviation, it occurs to me we have had several catastrophic collisions of airplanes taxiing on the runway when they should not have been there, miscommunication. While this may appear to be a small deviation, it looks like it has catastrophic results. It seems to me that ICAO and the FAA ought to be on the same wavelength and on the same words so that we don't have that confusion.

Mr. NEWMAN. Well, the illustration is such that the confusion augers toward a greater safety enhancement rather than to enhance the risk though, sir. If you assume that when you say "taxi into position" and you are a foreign pilot coming into the United States, that means you do not take the runway. All you do is come up to the runway on the taxiway. The problems that you speak to—and they are significant. There have been some significant accidents created by misunderstanding about who has the right of the runway. Those accidents, by and large, are not caused by American pilots understanding that they are to take position and hold on the runway.

Mr. LAUGHLIN. Well, I thought it was the foreign pilots we were addressing. That's where my concern is. That's the reason I asked what efforts you and your organization have taken to ensure that our air controllers use the more courteous, slow-speaking approach when they identify the pilot coming in—international flight, foreign tongue, second language being English, whether it is American English or the other kinds. Are you all making an effort to get the controllers to do this?

Mr. NEWMAN. I'm not aware of any. There is the FAA's concern, and they instruct their controllers when a foreign pilot comes into the environment to speak more slowly and distinctly.

Mr. LAUGHLIN. Mr. Kern was raising his hand. I certainly want to hear his comments on this area.

Mr. KERN. Thank you, sir.

I didn't want to leave the committee with the impression that controllers are not courteous and considerate of pilots, both domestic and foreign. As somebody who flies regularly as a pilot and in the jumpseat of many aircraft all over the world, I think that's a common courtesy that you see almost everywhere—North, South, East, and West. And it is not, I don't think, restricted to any particular geographic part of the world.

There seems to be a camaraderie between the pilots and the controllers that does contribute to the safety of the system and ease the flow of communications. It is rare, in my experience, that I see it otherwise. In fact, recently I have been over in the Soviet block countries working on arrangements to help some of our carriers open up some of the other airports riding in the jumpseats of U.S. and other carriers, dealing with issues like English-speaking controllers and emergency situations and alternate airports and others. We find that even the foreign controllers extend those same courtesies to the American flights coming in and out of their countries.

That's not to say that English as a second language is not a problem. It is, in fact, probably the single biggest number-one problem to opening up some of the new airports that the chairman was talking about, and certainly the airspace in and over the Soviet Union, itself.

Now, how do we deal with that? We are working closely with our governmental counterparts in the Soviet Union, as an example, to find a solution to this English as a second language problem. We've got to figure out a way to get them training.

One of the things that our air traffic service is doing right now, as an example, is actually taking Soviet controllers into their homes in Alaska; inviting them over to see our facilities; living in their homes; read, speak, and discuss things in at least the English language that is spoken in Alaska for a week or two.

We are looking for ways to fund formal training. Other countries of the world and the United Kingdom actually sponsor and pay for training in the English language.

I am not aware of any ICAO-sponsored classes, but we in the United States have got to wrestle with this issue, working with our industry, if our industry expects to have over-flight privileges and other international kinds of privileges in and out of those countries.

In discussions with those countries, they welcome that sort of help and would be eager to participate with the FAA, the industry, and the United States to find a solution to what I would call the number one factor in opening up some of those new territories and routes.

Mr. LAUGHLIN. I would imagine some of your ATCs have considerably more foreign flights than others. Does the FAA make any effort to hire air controllers who have some of these other languages either as their first or second language?

Mr. KERN. I don't think we have an explicit program that does that. I know we have controllers in facilities who by chance happen to speak Japanese, French, and other languages, but it is not a policy of the United States to do that.

Mr. LAUGHLIN. In my limited experience, U.S. carriers flying to some of these countries generally have at least one or more crew members or flight attendants who speak the language of the destination country, and it would seem to me that on the reverse side, if we've got planes coming from some of those areas of the world that we know frequent our airspace, it would enhance the safety if we had air controllers—I'm amazed that we can find someone like the chairman that has got the Slavic language in his repertoire, and it seems like we might be able to come up with some air controllers that have some of these other languages.

Mr. **Kern**. Yes, sir. It is surprising to me to see the linguistic capabilities of people who regularly fly outside the United States, and mostly the foreign nationals from the other countries—all crew members.

Mr. **Laughlin**. Well, I'd just point out that in my district, while there is a substantial Hispanic population that is readily recognized, there is also a substantial Czech population in my district—second and third generations—that speak Czech in their homes. It just seems to me that in this country we ought to be trying to hire some of these people with identifiable languages, and it seems that your agency ought to be putting forth some effort—I don't say spend 50 percent of your budget, but you certainly ought to advertise or seek those people out.

That's all I have. Thank you, Mr. Chairman.

Mr. **Oberstar**. Not only has the gentleman's time expired, but the second call of a recorded vote is underway in agreeing to the conference report on the Supplemental Appropriations Bill. I'd like to vote and return within 10 or 12 minutes, because I know there are other members who have a number of question. I alert all members that we will return promptly and proceed to those questions and try to complete this panel before taking a lunch break.

[Recess.]

Mr. **Oberstar**. The subcommittee will resume.

When we broke it was time to turn to Mr. Lightfoot of Iowa. The Chair recognizes the gentleman from Iowa.

Mr. **Lightfoot**. Thank you, Mr. Chairman, and thank all of you for your testimony and your patience with us this morning. We apologize for the vote, but there is nothing we can do about that.

To follow up on the line of questioning that we were on just before the break, in some of Mr. Newman's comments, as well as of Mr. Kern and Doctor Graeber, working in the real world and the real environment there are days out there that we have all experienced when pilots and air traffic controllers are singing together in a unified voice like a well-conducted symphony orchestra. And then possibly the next day, with maybe the same mix of pilots and the same mix of controllers, due to the moon signs or whatever, we've got a few people playing a little off key in our orchestra and it doesn't sound as good. But yet we are still using the correct phraseologies and we are doing all the things by the book.

I think we have pointed out this morning that you can do it by the book, so to speak, as far as phraseology is concerned, but, at the same time, you can be misunderstood because of the way that that particular phrase is being delivered.

I realize it is a difficult thing to deal with, and I don't even know that we are capable of doing that through regulation or something of that nature, but do you, the experts, recognize that as a problem? And, if so, what are we trying to do to get everybody singing out of the same choir book, but not only singing out the same choir book but singing with the same director?

Mr. Kern?

Mr. **Kern**. Mr. Lightfoot, we recognize that as an issue. One good example of a partial solution to that was an effort about eight years ago that we in the industry undertook to just define things that we say here in English. It is called our "Glossary of Terms." The commonly-used aviation terms and phrases that are now an attachment to the Airman Information Manual—it is a document similar to a dictionary that takes the hundreds of phrases and words that we all use and take for granted and think we know exactly what they mean and give them a common understanding. This effort was a joint DOD/government/industry/academic exercise.

If there is something that we need to do with that now, I would suppose, because of the globalization of the industry, as the chairman mentioned, and because of the influence that we are seeing now—and a growing influence, and it is probably going to be growing more rapidly than any of us expect in the next few years—that same kind of an effort should probably be thrust on the international scene right now to make sure that when we get the different nuances and the different understandings on an international basis right now they can be better defined.

And could I ask Doctor Foushee to continue with that?

Mr. **Lightfoot**. Certainly.

Mr. **Kern**. Because it involves some of the work that is involved in his work program.

Mr. **Foushee**. If I could just comment briefly, Mr. Kern mentioned in his testimony line-oriented flight training, which involves the use of sophisticated simulators. One of the techniques that is utilized along with LOFT is the videotaping of crews performing under complex circumstances. We have found that one of the things that makes that technique so particularly effective is that very often people don't understand or don't have insights into how they communicate with others, or they don't often perceive that they have styles that, in some cases, cause communication problems, and that kind of feedback has been shown to be very helpful in training.

We are encouraging wide-spread usage of LOFT and looking at applications for air traffic controller training, as well.

Mr. **Kern**. And I should add to that, to give it maybe a little more international flavor, Doctor Foushee and myself were recently at a symposium in Leningrad hosted by the Soviet Union, under the auspices of the International Civil Aviation Organization, to discuss training in human factors issues with the international community, much as we are discussing today. So there is an awakening and a better realization right now of the issue. That's why I suggest maybe it is time to take this glossary of terms and, once again, as part of the continuing improvement process, have it examined by the international community.

Mr. **Lightfoot**. Doctor Graeber.

Mr. **Graeber**. I'd just like to comment. In my testimony I briefly mentioned a study we had been conducting for the past eight months where we are actually recording communications at several TRACONs throughout the United States and applying very sophisticated linguistic analysis to really determine the information content that is in those communications. We don't really understand very well right now just what the limits of the information transfer problem are and how the human part of that is a source of error.

So we feel when we get this data we will have a much better understanding of the amount of information transferred and how the language gets in the way of transferring that information.

Mr. LIGHTFOOT. Just from personal experience, you take, at the very beginning, someone who has never been in the system—say a student that you are starting out with—something as simple as understanding the information on an ATIS. Until they have in their mind the order and the procedure that data comes down, it doesn't make a great deal of sense to them. Of course, we're talking about experienced commercial pilots who do this for a living. But, again, this is just an observation.

We would suspect that, since they are bolted to a chair basically 40 hours a week working traffic, that the air traffic controllers should be the best and the commercial pilots should be right in there with them, and those of us in general aviation are somewhere down the list. That's usually the way it is perceived, because we don't fly as often as the professionals do.

Yet, in practice it seems many times that—and I suspect I may be a little bit more attuned to it than just the fellow that has got an airplane that flies on weekends because we do try to teach students how to do it correctly—you hear many of the abuses from the so-called pros that take the shortcuts and use the 3.5s instead of 3,500, and this type of thing.

Mr. GRAEBER. Our research at NASA is also focusing, as I mentioned, on datalink. We think datalink has a lot to offer in this area—particularly in terms of reducing some of the communication requirements, the verbal requirements by the controllers, and reducing some of the congestion so they have more time to communicate more effectively with those that are out there.

For instance, in delivering possible, in delivering ATIS, delivering clearances, and so forth, using that technology may not only reduce the communication errors in communicating that information, but also provide more time to communicate more effectively in other areas, as well.

Mr. MINETA. Would the gentleman yield on that?

Mr. LIGHTFOOT. Yes. I'd be glad to yield.

Mr. MINETA. Doctor Graeber, could you follow up on that? Why would the use of datalink, as an example, cut down on those kinds of errors that you think might occur? What is it about datalink that would give us any assurance that, if it is a thermal printer that comes up, that someone tears that off to take a look at it?

Mr. GRAEBER. We're not sure what the right interface ought to be for that datalink technology. We are looking at those issues, as well, whether it is a printer, whether it is a display, and how the crew acknowledges what that input says. But at least you have removed at least one element or source of variance in terms of the verbal communication and misunderstanding of the verbal information. So you have reduced the source of error by at least one level.

If we develop the proper interface so we are sure that the communication is verified by the crew, it still does free up the controllers a bit from the amount of verbal input they have to put out to the crews and allows them more time to deal with the other issues.

Mr. **Mineta**. And is that datalink being looked at in terms of the communication between the airline with its own airplane, or between air traffic control and a specific aircraft?

Mr. **Graeber**. We're looking at it, in terms of our research at Langley, between the ground control and the aircraft, comparing that with the verbal communication. We are also starting to do some work with some of the airlines in terms of airline to aircraft communication, as well, in the field. We are looking at both issues.

Mr. **Lightfoot**. A moment ago Mr. Owens was talking about the congestion factor. Chicago O'Hare probably is a prime example. If we do follow recommended procedure and go through with all the readbacks, and so on, it does take so long to say something and so long to respond to that inquiry or that direction, as the case might be. And in those cases we do find shorthand probably speeds up the process. If a pilot is given somewhat of a complex directive by an air traffic controller and he understands all of it and simply replies "Roger," or whatever, you have taken a whole lot of conversation off of the line and opened it up for someone else to talk.

Providing that the pilot does totally understand the directions he has been given, I suspect that is probably okay. The air traffic controller is left with only one option—to assume that he heard it all and understands it all.

We find, in general aviation, once in a while—Oshkosh, I guess, would probably be a good example—there is not time to respond, you are working so many aircraft. And it seems to work. But it does induce that potential for a misunderstanding or something to take place. I assume that's where we feel that maybe datalink would fill that gap somewhere down the road because it is much, much quicker and it relieves that congestion. Quite frankly, we always tell students to fly the airplane first and talk second. I think that applies to airline pilots, as well. We can get behind in this whole process.

Mr. **Owens**. I think you have to be very careful when you start to make the kinds of changes that are being suggested. One of the more common mistakes an air traffic controller will make in clearances is to issue a clearance of "maintain 10,000." The pilot reads back erroneously, "Roger. Maintain 9,000." The controller misses the readback, probably because he is thinking ahead to his next activity. The recommendation was that we want to increase the number of readbacks, where the evidence is that just because a pilot reads back the clearance doesn't necessarily mean that the controller hears it in the correct manner.

The bottom line to everything, whether you are a foreign pilot or a U.S. pilot, of course, is that the responsibility in the end is the controller's. He issues a clearance. He receives acknowledgement for it. He now must ensure that it is followed correctly. That is the basic tenets of the air traffic control system.

There was a comment made about the attitude of the U.S. controller. I find it to be exemplary, quite frankly. If you go to Kennedy Airport and watch an afternoon session when you get the rush from Europe coming in. I think you would see the concern and the care that is taken with foreign pilots to ensure that they are complying with issued instructions because it is true that we can never be sure that the correct voice inflection or that the language is totally understood. The controllers understand that, and they do, in fact, watch the situation very, very carefully. But they are human. Mistakes are made occasionally. And I'm not sure you could put together a human system that would completely eliminate that.

Mr. Lightfoot. One final question. This deals with mechanical devices rather than human beings, and I address this to you gentlemen at the FAA.

Some time ago there was some research or some inquiry of minimum operational performance specifications for devices that prevented blocked channels used in two-way radio communications—in other words, the stuck mike and this sort of thing. What is the status of that? Where are we with it? Where are we going to go with it?

Mr. Kern. We have had several proposals over the years to evaluate various devices that would eliminate the stuck mike problem. We have worked with the manufacturers. We have worked with the operators. We are currently working on developing a standard for performance of that particular device.

Mr. Lightfoot. Thank you.

Thank you, Mr. Chairman.

Mr. Oberstar. The gentleman from California, Mr. Mineta?

Mr. Mineta. Thank you very much.

Let me follow up on that question right there. Do you have a time schedule in terms of following up on this stuck mike issue?

Mr. Kern. I don't have it with me today, sir, but I'd be happy to get back to you.

Mr. Mineta. Would you submit that for the record?

Mr. Kern. Yes, sir.

Mr. Mineta. I think this is something we ought to follow, Mr. Chairman. This is something that has been outstanding for a long time. Again, I think the technology is there to eliminate the problem of a stuck mike. I don't know whether it is the resistance of the airlines to buy this equipment or something else, but it seems to me this is something that we ought to be able to track pretty easily in terms of——

Mr. Oberstar. If the gentleman would yield on that point, please do respond both as to the technology—there are improved versions—and what steps the FAA has taken to require the use of more advanced microphone technology and report to the committee as well as Mr. Mineta.

Mr. Kern. Yes, sir.

[The information received from Mr. Kern follows:]

ADVANCED MICROPHONE TECHNOLOGY

The degree of technology thought to exist has gone unsubstantiated to this point since the RTCA document which develops minimum operating performance standards (MOPS) has yet to gain approval.

The RTCA's latest draft MOPS recommends the following:

a. Anti-Blocking Devices (ABD) equipment should prevent unintentional, continuous transmissions (struck mikes) by automatically terminating a transmission after 35 seconds and returning the radio to the receive mode. The equipment should warn the flightcrew that a transmission is about to be terminated and indicate when a transmission has been terminated. (A means of immediate operator override of the termination may be provided.)

b. ABD circuitry should prevent simultaneous transmissions by detecting the presence of a radio signal on the frequency and inhibiting the transmitter. (A means of immediate operator override of the transmitter inhibit function shall be provided.) In the event that an attempted transmission is inhibited, continuous reception should be maintained at flightcrew stations.

The draft MOPS was rejected by the RTCA's executive committee at its May 1990 meeting and was referred back to the RTCA SC-163 to resolve those issues unacceptable to the executive committee. The next meeting of SC-163 is scheduled for August 1990. Should SC-13 resolve the concerns of the executive committee, the earliest that the executive committee could reconsider the MOPS would be at the next scheduled meeting in early December.

Once approved by the RTCA, the Aircraft Certification Service will develop a technical standards order (TSO) based on the MOPS. The TSO process will take 6 months to one year after receipt of the final MOPS. Notwithstanding the development of a TSO, it is uncertain whether manufacturers will produce ABD equipment without a regulation requiring aircraft to be equipped with an ABD. It is equally uncertain whether operators will install and use ABD equipment voluntarily.

ATO-320

US Department of Transportation
Federal Aviation Administration

AIR TRAFFIC
BULLETIN
SERVICE TO MAN IN FLIGHT
CENTER • TERMINAL • STATION

Associate Administrator for Air Traffic

Bulletin No. 89-4
August 1989

Readback/Hearback

*FTE Every day, erroneous communications precipitate complex traffic situations; e.g., reports of near-midair collisions, go-arounds, aborted take-offs, and operational errors/deviations.

The need for words and word-sets that clearly, unequivocally, and unambiguously convey to the pilot a controller's intent is essential. It is called effective communication of ideas, and in aviation, "effective" has an added safety connotation. Perhaps the single, most important thought in communications is standardizing the manner in which we communicate. Standardization eliminates the need for interpretation and leads to a clearer understanding of what is expected. Standard phraseology is the language of Air Traffic Control. USE IT!!! It is the mark of our professionalism.

Controllers and pilots may attribute their errant communications to work load, frequency congestion, and inattentiveness, to name a few. The following are a few items that cause misunderstandings and have the potential for traffic conflicts:

- Poor mike technique
- Clipped transmissions
- Issuance of control clearances for several aircraft in one transmission without allowing time for acknowledgements
- Nonstandard phraseology (CB jargon).
- Readback of wrong altitude information.

A definite pattern of communication problems are prevalent in altitude usage of ten and eleven (one zero thousand and one one thousand) thousand. It appears that there is a tendency to misconstrue these clearances when frequently and repeatedly used with such restrictions as 10 DME at 11,000 and 11 DME at 10,000. Not only is there the possibility of the clearances and restrictions being misinterpreted, but there may be a hearback/readback problem on both the controller and the pilot's part. REMEMBER!!! It is the controllers responsibility to ensure the readback is correct. (7110.65 2-72b)

It is important and essential that we condition ourselves to be aware of these two misinterpreted altitudes and other instructions when issuing or listening to the readback of clearances.

In October, November, and December of 1988, the Pilot/Controller Communications Awareness Initiative Working Group was established to foster improved communications between pilots and controllers as a means of reducing operational system problems, increasing user professionalism, and enhancing system safety. An aviation publication, "A Call To Action" was sponsored by the working group to provide an overview of twelve vital areas, two of which were related to the issues of clearance readback/hearback.

Both controllers and crew members must continually stress the four "C's": Clarity, Completeness, Comprehension, and Compliance to reduce the "HEARBACK" problem that is forever ongoing. REMEMBER!!! If we give CLEAR, COMPREHENSIVE, and COMPLETE instructions, then COMPLIANCE will naturally follow.

SCHEDULE WITH SAFETY

LISTEN— READ BACK— COMPLY

By Capt. Tom Kreamer

Pilot/controller communication does not end when the microphone button is released.

"Thunder Air two twenty, slow to two seventy, turn right heading zero five zero, and descend and maintain one three thousand," calls the controller.

"O.K.," comes the reply over the controller's headset.

But who transmitted the reply—Thunder Air 411, Pride Air 917, USAir 707, Flying Tiger 321?

Three minutes pass and the controller hears "Dart Air four twenty two. Just had a near miss by 200 feet with a 747 at our altitude."

The controller, totally taken off guard, requests Dart Air 422's altitude.

"Just leveling one three thousand, Center."

"Negative, Dart Air. Climb *immediately* and maintain one five thousand; the previous clearance was for Thunder Air two twenty. Let's listen up, gentlemen," comes the response from the center controller.

An exaggeration? Not at all. It has happened innumerable times. It is happening today, and I assure you, it will happen in the future. We can only hope that the poor communications techniques will not cause a disaster.

What would have avoided this near midair collision? A simple "Roger, Dart Air four twenty two" read-back would have told the controller that the wrong aircraft had copied the clearance.

Somewhere the communications loop broke down, but more than one problem appears in the breakdown. First, the controller issued entirely too many instructions in one clearance, and a multiple clearance tends to create problems. Secondly, the controller should have warned the pilots of several aircraft having similar call signs. And the Thunder Air 220 pilot should have read back the clearance. Further, the unidentified "O.K." could have come from anyone, and sure enough, it didn't come from Thunder Air 220. Another unidentified party is "just leveling one three thousand," and finally some Dart Air aircraft on the frequency is instructed to climb to one five thousand. The potential for other troubles is high.

Proper communication

Each of us should take the time not only to listen to the air traffic control (ATC) communications between other aircraft and the air traffic controller, but also to try to understand the replies.

Those of us involved in ALPA's air safety structure are seeing a great increase in FAA filings of alleged violations. Too many result from poor communication techniques used by pilots and controllers.

In doing research for this article, I read through the glossary of both the Federal Aviation Administration *Air Traffic Control Handbook* and the *Airman's Information Manual* (*AIM*). I found the following key words and their meanings used in our everyday radio communications:

- "Affirmative"—Yes
- "Negative"—No
- "Negative contact"—Used by a pilot to inform ATC that: (1) previously issued traffic is not in sight (it may be followed by the pilot's request for the controller to provide assistance in avoiding the traffic); or (2) the pilot was unable to contact ATC on a particular frequency.
- "Roger"—"I have received all of your last transmission." It should not be used to answer a question requiring a yes or a no. (See affirmative/negative.)
- "Wilco"—"I have received your message, understand it, and will comply with it."

I searched everywhere I could think of and never found listed as proper phraseology, the use of such words as "Okey dokey," "Yep," "O.K." "10-4," "See ya," or "We'll do all that."

What's the rush?

While the words above apply mostly to pilots, the pilots are complaining about receiving clearances with the words "expedite," "best rate," and "immediately."

When an air traffic controller tells a pilot to expedite, the pilot senses an urgency that may just border on an emergency—perhaps conflicting traffic in the immediate vicinity.

As for "best rate," the expression has no definition—it can mean anything from a climb or descent that is comfortable to the extreme of one that causes the passengers to watch their ice cubes leave their refreshment glasses and float majes-

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Tom Kreamer, a DC-9 captain for USAir, is the vice-chairman for operations of ALPA's Air Traffic Control Committee and a member of ALPA's Human Performance Committee and Accident Investigation Board.

tically by in front of their eyes.

Sometimes when there is less than 1,000 feet to go in reaching an assigned altitude, I hear a voice coming through my headset requesting "Best rate to _____ feet, please."

In discussions I've had with controllers, I've found few who realize that the last 1,000 feet of climb or descent should be accomplished at a rate of 500 feet per minute. Though it is not in their handbook, it is in the *AIM*. (New-generation flight and performance management systems seem to have a difficult time with this one also.)

And finally, "Cleared for *immediate* takeoff." One must wonder, why the rush? If traffic is so close, we might want to wait. What happens during an "immediate takeoff" if we abort? Obviously this places another strain on the ATC system, because now the aircraft that was two or three miles out on final must go around and remain in the system.

"Immediately" is an important, sometimes critical word—when used in the proper context. "Expedite" and "immediately," in the controllers' own glossary, stress that the flight crew should comply to avoid an imminent situation. "Best rate"—who knows?

A revealing study

In 1983, the National Aeronautics and Space Administration issued a report titled "Addressee Errors in ATC Communications: The Call Sign Problem," prepared by Capt. William P. Monan of Battelle Columbus Laboratories. Previously the regional director of flight operations for an international airline, Monan studied deidentified Aviation Safety Reporting System (ASRS) reports to prepare his study.

Users of the aviation system submit a great deal of worthwhile information to ASRS. Some of the comments about and reasons for the communication errors may help us all, pilots and controllers, to improve our communicating skills.

Too many alleged FAA violations result from poor communication techniques used by pilots and controllers.

A few of the miscommunicated ideas, as well as some of the information given by crews, general aviation pilots, and controllers, follow:

- The deliberately over-abbreviated call sign—For various reasons, from workload problems to complacency, both controllers and pilots either made or were reported to have made intentionally shortened aircraft call signs during call-ups and in acknowledgments.

A pilot calling a center or reading back a clearance must use the full call sign. Using only the flight number or only the company name serves no purpose, except to degrade safety. Too often more than one aircraft have similar sounding flight numbers, and generally more than one company flight is on the frequency.

This is a problem not only for pilots but also for controllers. Many times a controller issues a clearance using just a flight number, only to receive a read-back from a pilot for whom the clearance was not intended.

- Errors related to frequency congestion—The *AIM* clearly points out that we must be certain that aircraft identification is complete before taking any action on an ATC clearance. It also reminds us that all read-backs and acknowledgments should be preceded by aircraft identification. As the *AIM* says, "The requirement becomes more important as frequency congestion increases."

Errors related to frequency congestion fall into three categories: anticipation, nonstop ATC transmissions, and clearance amendment problems.

- Anticipation—How many times have you been cleared into position and, as the controller transmitted a clearance, started to release the brakes and advance the throttles, only to hear the clearance issued to another aircraft on a crossing or parallel runway? This same type of anticipation occurs in other areas, such as awaiting a clearance for a previous request for a higher or a lower altitude.

Remember: *Listen—read back—comply*—don't take an action on your own.

- Nonstop ATC transmissions—A controller's nonstop transmission should make you realize that that controller is involved in a heavy workload situation and alert you to exercise caution in listening and responding to clearances.

If an overload situation is the problem, however, we must address FAA to correct that problem. We must not excuse the controller for the nonstop transmission, but neither can we excuse the crew who "thought" they received a clearance, were "unable to break in" for a read-back, and simply complied with the clearance—only to discover that the clearance was not for them.

- Clearance amendment problems, or "I can be a better controller"—Can you remember the times you were racked with frustration on being cleared 2,000, 3,000, 5,000 feet at a time, the infamous step climb or descent, only to have to stay at the assigned altitude for an extended period of time? Or just as you arrived at the cleared altitude and began to retard the throttles, received another altitude clearance? Or you received so much vectoring you were sure the controller had no idea where your destination was?

Frustrating? You bet! Can you do it better? Can you see all of the traffic the controller is working? Of course not! But some pilots—private, corporate, and air carrier—believe the controller is giving them a raw deal.

One unfortunate problem that

arises when some people get itchy for a clearance is that they initiate an argument over the radio—questioning the controller, asking for traffic, etc. Needless to say, this adds only tension and confusion to the system. There is no excuse for arguing over the radio.

Operating an aircraft in today's ATC system is considerably different from just a few years ago. With traffic at many terminals more than double what it was a short time ago, we are experiencing over-saturated frequencies and, in some cases, almost nonstop radio transmissions. These things, coupled with the system's having some controllers still in on-the-job training and some controllers working many hours of overtime, add an "edge" to a system that once had an almost relaxed atmosphere.

Recent report on hear-backs

In March 1986, NASA published "Human Factors in Aviation Operations: The Hear-back Problem," written by Monan, who again spent a great deal of time studying deidentified ASRS reports.

Monan opens his remarks by saying: "Every week during a two-and-a-half-year period, three to four 'Where are you going?!' hazardous occurrence reports have been submitted to the Aviation Safety Reporting System: . . . deviations from assigned altitudes, unauthorized taxi crossings of active runways, nonadherence to DME [distance measuring equipment] crossing altitudes, turns to incorrect vector headings, and various flights over the wrong jet or Victor airways. In all, 417 such errant actions were attributed by ATC controllers and airman reporters to misunderstood, misinterpreted, mistransmitted, or unheard numbers in ATC-to-cockpit communications exchanges. Of the 417 incidents reported, 85 reports were submitted by ATC controllers and 332 by crew members."

What is greatly disturbing is that many of these actions precipitated near midair collisions, go-arounds, traffic conflicts, aborted takeoffs, and, in some cases, certificate action by FAA. In other cases, the immunity granted by the use of the ASRS program aided in the pilots' avoiding certificate actions and ensured the reporting of these problems so they could be analyzed.

Of greater importance than the certificate action, which only the ASRS immunity prevented, is the absolute potential for disaster.

Monan points out that "perhaps no other essential activity in aircraft operations is as vulnerable to failure through human error and performance limitations as spoken communication. Decades of operational experience in aviation developed the read-back/hear-back confirmation procedure. When ATC messages pass unmonitored and unverified through the communications loops, the conflict alert frequently signals the occurrence of a misheard, unheard, or mishandled communication."

Enter the data link! ALPA, FAA, and the aviation industry have spent and will spend considerable time and resources developing a system enabling you to actually verify your clearance on a cathode ray tube display in the cockpit. Although this capability is still in the future, work is progressing steadily.

Subtle errors

In a great many ASRS reports, Monan notes, even though the controller received a read-back, it was incorrect and the controller did not catch the mistake—the conflict alert system did.

Many other reports, however, indicated that the nonflying pilot "assumed" the flying pilot had heard a new clearance or "thought" the flying pilot would change the new altitude in the altitude alert equipment. Assumptions, of course, have no place in the cockpit and almost invariably lead to serious conflict.

We must all realize that communication does not end when the microphone button is released. Crew coordination must be followed through to ensure that the entire crew is aware of a clearance.

Improving the system

For passenger and crew safety, we pilots must set the standard in using proper procedures.

A pilot who notices deficiencies in the system—poor communication techniques; argumentative controllers; extended step climbs, descents, or vectoring; or any other problem that degrades the overall ATC system—should call the ALPA Air Safety Hotline at 800-424-2470 and outline the problem encountered. In addition, the pilot should complete and mail a NASA ASRS form. The ASRS form will assist NASA and other responsible parties to pinpoint trouble areas within the system.

Remember, a pilot may complete and mail these forms as often as desired. Immunity is invoked only when FAA files a violation against the pilots.

Attaining the highest level of safety possible in day-to-day flight operations instead of degrading it is every pilot's goal.

To help achieve this goal, a pilot should:

- Always use complete call signs.
- Read back clearances, including numbers such as headings and altitudes, which if misread could cause serious incidents.
- Listen and make sure the clearance acknowledged is the clearance given for that pilot.
- If unsure of a clearance, ask the controller to "say again."
- Be especially cautious when a controller is involved with nonstop transmissions and/or multiple clearances.
- Not argue with the controller (we are in the system together).
- Not make unnecessary requests from ATC when the controllers are busy.
- Consider using headsets.
- *Listen—read back—comply.*

Sincerest appreciation and gratitude to the following aviation community groups for their support and contributions to this vital effort:

AIR LINE PILOTS ASSOCIATION
AIR TRAFFIC CONTROL ASSOCIATION
AIRCRAFT OWNERS & PILOTS ASSOCIATION
AOPA AIR SAFETY FOUNDATION
AIR TRANSPORT ASSOCIATION
DENRO
FEDERAL AVIATION ADMINISTRATION
(Air Traffic, Flight Standards, Aviation Safety, & Public Affairs)
GENERAL AVIATION MANUFACTURERS ASSOCIATION
NATIONAL ASSOCIATION OF AIR TRAFFIC SPECIALISTS
NATIONAL AIR TRAFFIC CONTROLLERS ASSOCIATION
NATIONAL BUSINESS AIRCRAFT ASSOCIATION

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**Federal Aviation
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Office of the Administrator

800 Independence Ave., S.W
Washington, D.C. 20591

FEB 23 1990

The Honorable James L. Kolstad
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, DC 20594

Dear Mr. Chairman:

This is in response to Safety Recommendations A-89-110 through -120 issued by the Safety Board on December 5, 1989. These safety recommendations were issued as a result of the Board's investigation of an accident on September 17, 1988, involving a Cessna 172. The airplane crashed into a mountain near Adams, Massachusetts, at approximately 1859 local time. The pilot was seriously injured and the two passengers were fatally injured. The pilot was flying visual flight rules from Westerly, Rhode Island, to Bennington, Vermont. At the time of the crash, the pilot was communicating with the Boston Air Route Traffic Control Center (Boston Center).

A-89-110. Require controllers in terminal radar facilities, when assigning a transponder code to a VFR aircraft in an emergency status, to execute computer commands so that the computer-assigned code will not inhibit the minimum safe altitude warning (MSAW) alarm.

FAA Comment. The Federal Aviation Administration (FAA) agrees with the intent of this safety recommendation. The FAA will issue an action notice directing controllers to assign transponder codes to visual flight rules (VFR) aircraft in emergency status that will allow minimum safe altitude warning (MSAW) alarms whenever practicable.

I will provide the Board with a copy of the notice as soon as it is issued.

A-89-111. Require controllers in terminal radar facilities, when providing emergency assistance to a VFR aircraft that has been assigned a transponder code which allows a computer status change but inhibits the minimum safe altitude warning (MSAW), to change the computer status of that aircraft so that the MSAW alarm feature is not inhibited.

FAA Comment. The FAA agrees with the intent of this safety recommendation. The FAA will issue an action notice directing controllers to change the beacon code of VFR aircraft in emergency status to one that will provide MSAW alarms whenever practicable.

I will provide the Board with a copy of the notice as soon as it is issued.

A-89-112. Provide radar control trainees in the en route option at the Radar Training Facility an emergency situation in which a VFR pilot is asking for assistance, is caught in weather, but is below the minimum IFR altitude.

FAA Comment. The FAA agrees with the intent of this safety recommendation. The FAA will review the En Route Radar Training Facility Course No. 50127 to include simulation training instruction as requested by this safety recommendation.

I will keep the Board apprised of the FAA's progress on this safety recommendation.

A-89-113. Provide radar control trainees in the terminal option at the Radar Training Facility an emergency situation in which a VFR pilot is asking for assistance, is caught in weather, but is below the minimum vectoring altitude.

FAA Comment. The FAA agrees with the intent of this safety recommendation. Classroom instructions addressing the type of situation described in the Board's accident report are presently administered at the FAA Academy during the Radar Training Facility Course No. 50027. The FAA agrees that classroom instruction alone is insufficient and would be effectively reinforced through the use of simulation training techniques. The FAA will, therefore, develop a simulation lesson plan to be administered by the FAA Academy that includes the scenario recommended in this safety recommendation.

I will keep the Board apprised of the FAA's progress on this safety recommendation.

A-89-114. Advise all radar controllers and supervisors currently working in en route and terminal facilities of the importance of following procedures provided in paragraph 9-10 of handbook 7110.65, Air Traffic Control, when providing assistance in emergencies; illustrate the importance of following procedures by providing the account of the accident described in this letter (A-89-110 to -120); and provide training on the proper handling of VFR pilots in weather difficulty below the minimum vectoring altitude or minimum IFR altitude.

FAA Comment. The FAA agrees with the intent of this safety recommendation. The FAA will issue an article in its Air Traffic Bulletin to remind controllers of the importance of the procedures mentioned in this safety recommendation.

Additionally, emergency procedures are a part of the annual air traffic controller proficiency development. The FAA believes that this training, along with the action notice to be issued in response to Safety Recommendations A-89-110 and -111, will increase controller awareness and understanding of the situation.

I will provide the Board with a copy of the article as soon as it is published.

A-89-115. Amend handbook 7110.65, Air Traffic Control, paragraph 9-24, "Radar Assistance to VFR Aircraft in Weather Difficulty," by changing the term "minimum safe altitude" to "safe altitude (MEA/MOCA/MVA/MIA)" so that the term does not become confused with "minimum safe altitude" (MSA) as defined in the FAA's Pilot/Controller Glossary.

FAA Comment. The FAA agrees with the Safety Board that the term "minimum safe altitude" in Handbook 7110.65, paragraph 9-24, can be confused with the term "minimum safe altitude" as defined in the Pilot/Controller Glossary. However, the term "safe altitude" is not synonymous with MEA/MOCA/MVA/MIA and is, therefore, not easily understood. The FAA believes that the wording in Handbook 7110, paragraph 9-24, should be modified to read: "the appropriate minimum altitude (MEA/MOCA/MVA/MIA)." The FAA will issue a change proposal and will distribute this proposal for comment.

I will keep the Board apprised of the FAA's progress on this safety recommendation.

A-89-116. Amend handbook 7110.65, Air Traffic Control, to require controllers to transmit the phrase "Caution, Terrain Clearance Not Provided" when issuing a vector to a VFR aircraft, or an IFR aircraft under emergency conditions, that is below the minimum vectoring altitude or minimum IFR altitude.

FAA Comment. The FAA does not believe that this requirement should be included in Handbook 7110.65. There are circumstances when it may be a good technique to tell the pilot that the controller is not providing terrain and obstacle clearance. However, requiring that controllers tell aircraft in distress that he/she is not providing terrain clearance in all cases could be counterproductive. The pilot in distress, whether in VFR or IFR conditions, will not necessarily benefit from being told that terrain clearance is not provided. Instead, this transmission could increase tension in the cockpit, as well as add to the number of transmissions at this critical moment. I believe that the actions taken in response to Safety Recommendations A-89-112, -113, and -114 will enhance the training and experience of terminal and en route radar controllers to manage situations addressed by the subject recommendation. These efforts are considered more constructive than mandating a requirement for a controller which may not offer a constructive option to a pilot.

Paragraph 9-1d of Handbook 7110.65F states: "Because of the infinite variety of possible emergency situations, specific procedures cannot be prescribed. However, when you believe an emergency exists or is imminent, select and pursue a course of action which appears to be most appropriate under the circumstances and which most nearly conforms to the instructions in this manual." I believe that the current procedures and the actions proposed in the companion safety recommendations address the intent of this safety recommendation.

I consider the FAA's action to be completed, and I plan no further action on this safety recommendation.

A-89-117. Provide direction and training to all first-line air traffic control supervisors regarding the immediate courses of action that should be taken if they observe a controller under their supervision making an error while working actual traffic that would create a dangerous situation.

FAA Comment. The FAA does not agree with this safety recommendation. The FAA believes that the circumstances surrounding this specific accident were local and not an FAA-wide discrepancy. Directives and procedures are already in existence regarding the course of action that should be taken by a first-line supervisor when observing a controller making an error while working actual traffic. The FAA's procedures require that a supervisor ensure that appropriate corrective actions are taken whenever controller deficiencies are noted.

On November 22, 1988, the air traffic manager at Boston Center published revised emergency checklists concerning controller actions, supervisory actions, and area manager-in-charge duties. The area supervisor emergency checklist states, in part, that the area supervisor is charged with the responsibility for safe and effective handling of the emergency.

I believe that the FAA's current procedures address the intent of this safety recommendation, and I plan no further action.

A-89-118. Provide the capability of displaying the maximum elevation figure (MEF) to controllers in air route traffic control centers (ARTCC) via the radar display.

FAA Comment. The maximum elevation figure (MEF) is a duplication of warning software service that already exists within the VFR elements of the en route minimum safe altitude warning (E-MSAW) enhancement. The addition of a functionality list usually generates added clutter to the radar scope. This is especially significant when the combined functions of

E-MSAW, Conflict Alert, Mode C Intruder, and the Arrival Sequencing Program/En Route Spacing Programs are in an operational mode. The FAA will, however, revisit the proposed MEF requirement in light of the functions listed above and replace it with emphasis on the application of advisory procedures presently available and functional.

Additionally, an associated software and training cost of 12 to 18 months for operational implementation of a new MEF function can be anticipated. It is noted that the proposed radar display of the MEF would utilize a corridor concept without definitive aircraft position. The benefit appears small in relationship with the present positive tracking mechanism.

A-89-119. Provide information to all air traffic controllers detailing the actions they should expect from first-line supervisors if, in the supervisor's judgment, the controller's actions while working actual traffic have been incorrect and have created a dangerous situation.

FAA Comment. The FAA does not agree with this safety recommendation. The FAA believes that the circumstances surrounding this specific accident were local and not an FAA-wide discrepancy. Directives and procedures are already in existence regarding the course of action that controllers should expect from first-line supervisors when, in the supervisor's judgment, the controller's actions have been incorrect. The FAA's procedures require that a supervisor ensure that appropriate corrective actions are taken whenever controller deficiencies are noted.

On November 22, 1988, the air traffic manager at Boston Center published revised emergency checklists concerning controller actions, supervisory actions, and area manager-in-charge duties. The area supervisor emergency checklist states, in part, that the area supervisor is charged with the responsibility for safe and effective handling of the emergency.

In the first quarter of calendar year 1989, the FAA's New England Region issued an alert bulletin regarding the handling of emergencies and emergency checklists. This procedure was a mandatory briefing item for all air traffic control personnel in the New England Region.

Additionally, Article 65, Section 1, of the agreement between the National Air Traffic Controllers Association and the FAA, effective May 1989, states that in the event of a difference in professional opinion between the employee and the supervisor, the employee shall comply with the instructions of the supervisor.

I believe that the FAA's current procedures address the intent of this safety recommendation, and I plan no further action.

A-89-120. Issue a General Notice (GENOT) to all controllers reminding them that a conscious effort must continually be made to identify and correct communication errors that pilots make in response to controllers' transmissions.

FAA Comment. The FAA does not believe that there is a need to issue a GENOT as recommended by this safety recommendation. There have been several efforts taken by the FAA to address this issue. During the period of October 1 through December 31, 1988, the FAA's Pilot/Controller Communications Awareness Initiative Working Group was established to foster improved communications between pilots and controllers as a means of reducing operational system problems, increasing user professionalism, and enhancing system safety. The working group published a document entitled "CALL TO ACTION" to provide an overview of 12 vital areas of communications concerns that were responsible for a great proportion of controller/pilot incidents. I have enclosed a copy of the document for the Board's information. This document was distributed to all air traffic controllers, all user organizations, all interested international organizations, and to a vast majority of private pilots through the FAA's Accident Prevention Program. Several of the major airlines have incorporated this document into their training program.

In August 1989, the FAA published an Air Traffic Bulletin addressing the readback/hearback issue as a mandatory briefing item. The FAA is in the process of publishing another article in the next issue of the Air Traffic Bulletin to address this same issue. I have enclosed a copy of the August 1989 Air Traffic Bulletin for the Board's information.

I believe that the FAA has met fully the intent of this safety recommendation. I consider the FAA's action to be completed, and I plan no further action on this safety recommendation.

Sincerely,

JB Busey

James B. Busey
Administrator

Enclosures

National Transportation Safety Board
Washington, D.C. 20594
Safety Recommendation

Date: December 5, 1989
In reply refer to: A-89-110 through -120

Honorable James B. Busey
Administrator
Federal Aviation Administration
Washington, D.C. 20591

On September 17, 1988, about 1859 local time, N6586J (86J), a Cessna 172, crashed into a mountain near Adams, Massachusetts.1/ The pilot was seriously injured and the two passengers were fatally injured. The pilot was flying by visual flight rules (VFR) from Westerly, Rhode Island, to Bennington, Vermont. At the time of the crash, 86J was on a radar vector from the Boston Air Route Traffic Control Center (Boston Center). The Boston Center controller had allowed the pilot to maintain 3,000 feet; the minimum vectoring altitude (MVA) in the area was between 4,700 and 5,000 feet msl. The last transponder return received by the Boston Center indicated that the airplane was at an altitude of 2,700 feet msl.

The pilot of 86J had encountered difficulty with weather and began circling a field. Because 86J was at a low altitude, reception of its transmissions at Federal Aviation Administration (FAA) facilities was poor, and the flightcrew of Monarch 58 (MON58), a Boeing 757 en route from Orlando, Florida, to Bangor, Maine, at flight level 370, heard 86J's transmissions and relayed instructions from the FAA facilities to 86J. Many people at several locations became actively involved in the final 16 minutes of the flight. Transmissions during the final moments of the flight were also received at the Westover Air Force Base in Chicopee, Massachusetts.

The Accident

At 1843, the pilot of 86J transmitted on the emergency frequency,2/ "I'm a little confused right now; I'm in trouble and I'm around Pittsfield Airport; I am clouded in with clouds and I'm circling over a field that is a possible landing site [ah, I request that you put me on radar possibly to verify my position. I have mode C capability]."3/ MON58 replied, "Cessna 656J, just

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1/For more information, read NTSB Field Accident Report NYC-88-FA-236.

2/121.5 MHz on the very high frequency (VHF) band and 243.0 MHz on the ultrahigh frequency (UHF) band are designated as emergency frequencies and are continuously monitored [guarded] by most FAA and military ATC facilities.

3/All transmissions enclosed in brackets [] indicate transmissions from 86J that were not received at either the Boston Center or Albany Approach. These transmissions were received by the Westover Air Force Base, and presumably received by MON58. Mode C capability allows the controller to see the altitude of the airplane on the radar display.

understand you're in a little bit of trouble navigation wise, you're in ah the Pittsfield area, Pittsfield, confirm." The pilot of 86J replied, ["Yes, Pittsfield, Mass. I'm only about north-east, possibly probably about 10 miles."] The controller working the radar position at the Pawling Sector, Sector 06, at the Boston Center overheard the transmission from MON58 and replied, "656J, this is Boston Center on guard; if you hear, ident." About the same time, the controller working the D-side of Pawling Sector at the Boston Center called Albany Approach Control and said, "...we just had a 656J say he was having trouble or something about he was in the level in ah layers of fog in the Pittsfield area." The controller working the Radar South position at Albany Approach replied, "OK, I'll come up on the frequency and see if I can do anything." He then transmitted, "This is Albany Approach on 121.5. Is there an aircraft near Pittsfield, I believe the sign is 656J, needs assistance?" MON58 replied, "That's affirmative Boston. It's a Cessna 656J; Monarch, who's talking to him and we understand he's got navigational problems and he has mode C capability." The Radar South controller at Albany Approach then said, "All right, if you could pass along to him, tell him to squawk 5227; I'll see if I can pick him up."

MON58 relayed the information to 86J, who repeated the code, and said, "I pushed the ID button." MON58 said, "Thank you, ah, could you give us your altitude, please, your altitude, and confirm your call sign." 86J replied, "My altitude is three thousand feet and I'm circling over a field which is a [good landing site. If I need to I can land.] I estimate that I probably have about thirty minutes of fuel and I decided [that this is a good way out until I get out.]" MON58 replied, "That's affirmative, sir; stay where you are and just confirm your call sign please."

At 1847:19, 86J replied, ["Cessna six five eight six Juliet, stationed in Bennington State Airport, Vermont."] MON58 then repeated this information and asked, "...did you copy that Boston?" Boston Center did not reply to this question, but Albany Approach replied by saying, "...I don't have him on radar; he's probably too low for my coverage; he wants to get to Bennington?" About the same time, the Pawling D-side controller at the Boston Center called Albany Approach and asked if it was hearing the guard (emergency) frequency. Albany Approach replied that it was, and that a controller had issued 86J a "squawk" (four-digit transponder code). The Pawling D-side controller asked if Albany Approach saw 86J on radar. Albany Approach replied that it "didn't even see a primary or anything out there; it might be real low." 86J then appeared on the Boston Center radar. The Pawling D-side controller said, "...he's 2,800 feet...." Albany Approach replied that they would look for him.

At 1847:43, the Radar South controller at Albany Approach transmitted on 121.5 to MON58, "...I don't have him on radar, he's probably too low for my coverage; he wants to get to Bennington." MON58 replied, "That's his base...and it's call sign 6586J, and he's got thirty minutes of fuel. He's orbiting over a large airfield, and ah at 3,000 feet, staying in that position until he gets assistance or he'll decide to land there; he can't confirm the field." The Radar South controller at Albany Approach then transmitted, "Boston Center says he might be six miles south of the Grave intersection which would put him in the vicinity of North Adams Airport, and there's also a large mountain peak there, three thousand seven hundred feet. Tell him to use caution." MON58, in turn, transmitted to 86J, at 1848:23, "Understand that Albany Approach thinks you're in the Adams Airfield vicinity. Ah, the ah field has, ah, a large ah hump on the ah the field, so use caution if you decide to make a forced landing." 86J replied, ["I'm just circling; if you can't get me on radar, then I definitely should make provisions to land."] MON58 transmitted, "Yes sir, they're having difficulty picking you up at the moment; there's no reply on 5227." A few seconds later, MON58 transmitted, "We're listening out sir, so, ah, ah, so don't hesitate to call us if you need assistance." 86J replied, ["...I am going to lower down and check the field out."] MON58 then replied, at 1849:17, "That's affirmative; do a low pass and check the field for any obstructions. Ah, we think, ah, they think you're in the Graves intersection and it's ah possibly Adams or Andrews I think airfield." [The pilot of 86J then said that the landing airport was just a hay field.] MON58 repeated that information, and then called Albany Approach, trying to contact that facility from 1849:44 to 1850:10. At 1850:18, MON58 transmitted, "There's a slight confusion about this field. It's just a hay field; he's orbiting over a large ah hay field not a landing strip." The Pawling D-side controller at the Boston Center then called Albany Approach and said that the Pawling Sector had the emergency on radar. The controller working the Radar North position at Albany Approach answered, "You see anything on a 5227 code?" The Pawling D-side controller at the Boston Center replied, "Affirmative. He's seven miles northeast of Pittsfield...just north of the Dalton Beacon by three miles."

By this time, controllers at several positions at Albany Approach and the Boston Center were involved in communications with each other. At 1850:35 MON58 transmitted, "Gonna make a low pass and check the field out for any obstructions and ah then he's gonna make a forced landing."

The Radar North controller at Albany Approach and the controller working the D-Side of the Gardner Sector at the Boston Center had also been communicating about the position, altitude, and heading of 86J. At 1850:54, the Gardner D-Side controller at the Boston Center said, "Now it looks like he's heading eastbound." The Radar North controller at Albany Approach said, "All right I think we're gonna try to get him to go westbound towards Pittsfield Airport." The controller working the Radar Coordinator position at Albany Approach transmitted to MON58 at 1850:53, "And Monarch, if you could relay to him there is an airport approximately seven miles west of his position, it is known as the Pittsfield Airport."

At 1851:02 MON58 called 86J and said, "Roger, Albany Approach ah recommends an airfield named Pittsfield seven miles west of your present position,...airfield called Pittsfield." The pilot of 86J then transmitted to Monarch, ["We're going to try a course direct west from here and see what we can do."] MON58 replied, at 1852:10, "Ah eight six juliet, say again, please, this is Monarch." 86J again transmitted, ["...we are just headed west and ah we are going to maintain a course of west and you say approximately seven miles we should run into Pittsfield."]

MON58 then contacted Albany Approach and advised that 86J was "...heading toward Pittsfield Airfield now ah he's gonna maintain a heading of west." At 1852:55, MON58 transmitted, "Just confirm that range was seven miles from his position." The Gardner D-side controller at the Boston Center then noted, "He's headed westbound now." In a background discussion, in Albany Approach Control, at 1852:57, someone said, "...get rid of this sucker because whoever got him on radar should be...." Shortly after, the controller working the Final Vector position at Albany Approach asked the Pawling D-side controller at the Boston Center, "If you have him in radar there, why don't we put him over on your frequency?" The Pawling

D-side controller then suggested 121.35, or 128.1, "...put him on 128.1." At 1853:41, the Radar Coordinator at Albany Approach told MON58, "...if you could have 86J, he's in radar contact with Boston Center, frequency 128.1, if you can maintain his present altitude as long as possible." About the same time, the Radar North controller at Albany Approach told the Gardner D-side controller at the Boston Center that the Pawling Sector's "got him in radar also they're going to be working him trying to get him towards Pittsfield...."

At 1853:53 MON58 said, "Roger, Boston, ah, now have you on radar contact, sir, ah, go to frequency 128.1, 128.1, speak to Boston, and stay at your present altitude, stay at your height." The pilot of 86J asked MON58 to repeat the information, which was accomplished. Then 86J repeated the frequency and said, "Okay, changing frequencies now." About the same time, Albany Approach told the Pawling D-side controller at the Boston Center, "You're gonna work him, listen, he supposedly only has about twenty five minutes of fuel now." The Pawling D-side controller acknowledged. During this same time period, Albany Approach told the Gardner D-side controller at the Boston Center, "...Pawling Sector's got him in radar also they're gonna be working him trying to get him towards Pittsfield I believe is what it is." The Radar North controller at Albany Approach had been in communication with the Gardner Sector at the Boston Center. At 1855:32, the Radar North controller said, "...I'm coming off the sixty line...keep an eye on him please...Pawling's going to be working him...." The Pawling D-side controller at the Boston Center then asked the Final Vector controller at Albany Approach who the other aircraft was that was talking to 86J, and learned that it was MON58. The Pawling D-side controller then told the Final Vector controller to have MON58 also switch to frequency 128.1, one of the frequencies available on the Pawling Sector. The Final Vector controller acknowledged. At 1855:06, the Radar Coordinator at Albany Approach transmitted, "And Monarch this is Albany Approach if you could monitor 128.1 just to let them know you are on frequency if you can provide ah Boston Center any further assistance." MON58 acknowledged and then contacted the Pawling controller on 128.1 MHz.

At 1856:05, MON58 transmitted, "86J, this is Monarch. Boston is calling you; would you ident please for them?" The Pawling Radar controller then transmitted, "Okay Monarch, can you hear Boston?" MON58 replied, "Affirmative." The Pawling Radar controller then said, "Okay Monarch, tell 86J to turn five zero, fifty degrees to the left, fifty degrees to his left."

MON58 then established contact with 86J, and at 1856:40 told 86J to "...turn five zero, fifty degrees left." The pilot of 86J replied to Monarch, ["Ah if I if I turn fifty degrees, that's going to, I am turning right to fifty degree heading right now."] MON58 repeated, "Turn left fifty degrees from present heading, turn left fifty degrees from present heading; maintain your altitude of three thousand feet, please." MON58 paused and then asked, "What's the new heading please, 86J?" The pilot of 86J replied, ["Ah this is 86J. I am currently on a course of north and I am over a village. I didn't understand the transmission and turned to a heading of fifty, started to so I wasn't sure where I was at; right now I am at north, heading of north, and I am over a city."] MON58 then replied, at 1857:24, "Okay, turn on to a heading two two ah eight ah zero initially ah maintain three thousand." 86J then replied, ["Heading of two twenty eight."] MON58 then told the Boston Center, "Roger, I'm turning him onto a heading of two eight zero, and he's tried to overshoot his heading." The Pawling Radar controller replied, "Okay, he appears to be on a northerly track right now with Boston Center; he does have North Adams Airport in his ten o'clock position two and a half miles right now it should be twelve o'clock two miles North Adams Airport."

At 1858:08, MON58 transmitted to 86J, "Roger, there's North Adams Airfield at your ten o'clock or twelve o'clock position about two miles, two miles ten to twelve o'clock position, North Adams Airfield. Report when you have contact." The pilot of 86J replied, ["Ah, I'm completely in the clouds right now, um, I am on a heading of west, two hundred and seventy degrees, and I am at twenty eight hundred feet."] MON58 then relayed new information from the Pawling Radar controller to 86J that the airport was now in his 2 o'clock position, 2 to 3 miles.

At 1858:48, the Pawling Radar controller at the Boston Center called Albany Approach and asked, "...what's the runway at North Adams?" Albany Approach replied that it was "eleven and two nine." The pilot of 86J then transmitted, ["...dropping altitude to twenty five hundred feet to try to get out of the clouds."] MON58 replied, "Okay, twenty five hundred feet, roger." MON58 then transmitted, "Boston, he's ah descending to twenty-five hundred; he's ah in clouds at three thousand." The Pawling Radar controller at the Boston Center asked, "He's in the clouds at three thousand?" MON58 answered, "...yeah, could you give ah him lower, please?" The Pawling Radar controller replied, "Okay, stand by." The Pawling Radar controller then called Albany Approach and asked, "...what's the MVA 4/ right around the North Adams Airport? I got this guy about three miles south of the airport." Albany Approach answered that it was 4,700 and 5,000 feet. Following this exchange, at 1859:30, the Pawling Radar controller transmitted, "...eight six Juliet, ah correction Monarch, the runways are eleven and two nine runway one one and runway two nine at North Adams." MON58 repeated the information, and then asked 86J, "What altitude are you at now?" The pilot of 86J did not reply. The Boston Center received the last radar return from 86J at 1859:31.

Investigation

During the investigation of the accident, the Pawling Radar controller told Safety Board investigators that she first became aware of 86J when she heard other aircraft trying to talk with 86J on the emergency frequency. She then listened to MON58 trying to talk with 86J and heard MON58 telling 86J to squawk 5227. She then entered this code in her code select list.5/ She advised Albany Approach that 86J was in radar contact, and then forwarded 86J's position to Albany Approach. She said "that for some reason" she had determined that 86J was being worked by Albany Approach. She then had gone back to her traffic, which she said was 8 to 11 airplanes.

When Safety Board investigators asked what information she had on 86J at 1853:45 when she began calling 86J on frequency 128.1, the Pawling Radar controller

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4/MVA--minimum vectoring altitude is the lowest altitude at which an IFR aircraft will be vectored. Limiting factors are terrain height and radar coverage.

5/Entering a code in a code select list provides a controller easier identification of the airplane by allowing associated alphanumerics to be presented on the radar display.

responded that she felt that 86J was disoriented, nervous, circling, and asking for some direction. She said she told MON58 to tell 86J to turn 50 degrees to the left, which would have been a northwesterly direction. She felt that 86J was trying to go in that direction, but was tracking toward the northeast. She therefore questioned the validity of the pilot's instruments. When MON58 advised that 86J wanted a lower altitude and was in the clouds, she recalled being surprised. Up to this time, she thought that 86J was flying VFR and complying with requirements to remain VFR.

The Pawling Radar controller said that when she called Albany Approach, asked what the MVA was, and was told 4,700 feet, she "sank," because "there was obviously something out there," and 86J's mode C return was indicating 2,700 feet. She said the radar target then disappeared and MON58 lost communications with 86J.

The Pawling Radar controller's immediate supervisor, the Area Supervisor, was standing close to where the Pawling Radar controller was seated. He said he had observed 86J tracking northbound. He heard the Pawling Radar controller give the 50-degree left turn order and then heard the controller sitting to the left of the Pawling Radar controller say that the MVA was 4,700 or 5,000 feet. The Area Supervisor recalled that the controller to the left of the Pawling Radar controller said that there were mountains there; the Area Supervisor then told the Pawling Radar controller about mountains being there. The Area Supervisor said he did not know the actual flight conditions that 86J was encountering. When he learned that the airplane was circling a field, however, he assumed it to be in VFR conditions. About the time the Pawling Radar controller asked for the MVA, he said that his thought was, "How can we countermand this?"

During this period, two other supervisors were behind the Pawling Radar Sector at the Boston Center. One of them, the Area Manager-In-Charge, mentioned that "there were hills out there." The other supervisor, from an adjacent sector, had come to the Pawling Sector for the purpose of warning them about Mount Greylock in the area. He told the Pawling Radar controller and her supervisor, "Don't forget about Mount Greylock," and then added that its height was 3,900 feet. He recalled getting an acknowledgment from the controller's supervisor but not from the Pawling Radar controller. He said that he felt that things were tense enough at this point without having a supervisor from another area bothering them, so he "got the heck out of there."

Discussion

The Safety Board believes that a correct decision was made to allow the Boston Center to assist 86J because Boston Center had radar contact with 86J and Albany Approach did not have radar contact when the decision was made. The airspace assigned to the Pawling Sector was above and close to airspace assigned to Albany Approach. Although 86J was in Albany Approach's airspace, the Pawling Sector was the logical sector to assist 86J because it communicates frequently with Albany Approach and it had radar contact with 86J.

When Albany Approach, an automated radar terminal systems (ARTS) facility, began assisting 86J, the Albany Radar South controller instructed the computer to assign a VFR code to the aircraft. The computer selected one of the codes in the 5200 series, which is reserved for VFR aircraft. The Radar South controller then issued the code selected, 5227, to the pilot of 86J. The minimum safe altitude warning (MSAW) at Albany Approach was functioning; however, the VFR computer codes inhibit VFR aircraft from activating the MSAW alarm at ARTS facilities. Had 86J remained in radar contact with Albany Approach, Albany Approach would have been trying to assist 86J without the redundancy of the MSAW alarm. On the date the accident occurred, Boston Center, an air route traffic control center (ARTCC), did not have an en route minimum safe altitude warning (E-MSAW) adapted for the geographic area in which the accident occurred. Had the E-MSAW been available, 86J would have activated the alarm because VFR computer codes do not inhibit VFR aircraft from activating the E-MSAW alarm in ARTCC facilities; the Boston Center controller then would have been obligated to issue a low altitude safety alert. A VFR aircraft being assisted by a terminal facility could activate an MSAW alarm if the controller instructed the computer to assign a code that did not inhibit the alarm. Such instruction requires one additional keystroke, the same as when a controller requests a code for an IFR aircraft. The low altitude alert is a valuable feature of the ATC system; the Safety Board believes that when a terminal radar facility offers assistance to a VFR aircraft that is equipped with mode C capability and is in an emergency status, the controller should request an uninhibited computer code so that the VFR aircraft has an opportunity to receive a safety alert based on an MSAW alarm.

Handbook 7110.65, Air Traffic Control, provides procedures and guidance for controllers. Chapter 9, Paragraph 9-2, "Emergencies," tells the controller to obtain enough information to handle the emergency intelligently.

> Base your decision as to what type of assistance is needed on information and requests received from the pilot because he is authorized by FAR 91 to determine a course of action.

Paragraph 9-10 states that minimum information required for handling in-flight emergencies is (1) aircraft identification and type, (2) nature of the emergency, and (3) pilot's desires. The controller is told to obtain additional information after initiating action; a list of 14 items is provided. The Pawling Radar controller knew some of these items because 86J was in radar contact. Two important items for this set of circumstances, however, were not known: the pilot-reported weather, and the pilot capability for IFR flight. The Safety Board notes that neither the Pawling Radar controller nor the Area Supervisor attempted to obtain this information.

Chapter 9, Paragraph 9-24, "Radar Assistance to VFR Aircraft in Weather Difficulty," states:

> If a VFR aircraft requests radar assistance when it encounters or is about to encounter IFR weather conditions, ask the pilot if he is qualified for and capable of conducting IFR flight.
>
> * * * * * * *
>
> If the aircraft has already encountered IFR conditions, inform the pilot of the minimum safe altitude. If the aircraft is below the minimum safe altitude and sufficiently accurate position information has been received or radar identification is established, furnish a heading or radial on which to climb to reach the minimum safe altitude.

The Boston Center made no attempt to determine whether the pilot of 86J was qualified and capable of conducting IFR flight nor did the controller inform the pilot of a safe altitude and provide a course on which 86J could climb to reach a safe altitude. The Pawling Radar controller did not ask the pilot any questions. The controller did not know the pilot-reported weather or pilot capability for IFR flight. Under the circumstances, these items were the 2 most important of the 14 additional items of information the controller should obtain in an emergency. The left turn of 50 degrees was issued before a safe altitude or minimum vectoring altitude (MVA) was known. The decision to turn the aircraft apparently was based on a series of assumptions. Even after the turn was issued and the MVA became known, the Pawling Radar controller did not provide an appropriate heading and te[illegible] 86J to climb to a safe altitude. Instead, the controller attempted to inform the pilot about the runways at North Adams airport.

The Safety Board considers the series of errors by the controller and supervisors to be a serious deficiency in handling emergencies. The controller should not have issued a vector without knowing the pilot-reported weather, capability for IFR flight, and the MVA. Additionally, when the controller discovered the MVA for the area was 4,700 to 5,000 feet, she took no corrective action. Several supervisors were observing, but none mentioned anything about having the pilot of 86J climb on a course to avoid high terrain. One supervisor was wondering how to "countermand the situation." The action taken and the lack of appropriate action were contrary to basic information contained in the ATC handbook. The emergency procedures in this case were not properly executed.

Paragraph 9-24 contains the wording "minimum safe altitude." The Safety Board believes that this wording could become confused with the defined term "minimum safe altitude (MSA)" in the pilot/controller glossary. The MSA is depicted only on approach charts used for instrument approaches or is defined generally in the Code of Federal Regulations, Part 91, and is not the same as the MVA. The Safety Board believes that this wording should be deleted where it appears in paragraph 9-24, and "safe altitude (MEA/MOCA/MVA/MIA)" be inserted to express the intent of the paragraph.

The Pawling Radar controller told investigators that her training had not covered a situation in which a VFR pilot was caught in weather, was asking for help, but was below the MVA. According to the FAA, however, the en route controller option in its Radar Training Facility (RTF) located in Oklahoma City provides instruction to controllers for handling VFR pilots experiencing weather difficulty below the minimum safe altitude (MSA). The Safety Board believes that exercises involving MSAs should be accomplished in the terminal option as well as in the en route option. More importantly, however, an en route radar controller should be concerned with the MVA or the minimum IFR altitude (MIA) and with the correct course of action to pursue if a pilot operating under VFR asks for assistance. The Safety Board therefore believes that future radar control trainees in the en route option at the RTF should receive training for an emergency situation in which a VFR pilot is requesting assistance, is caught in weather, and is below the MVA. The Safety Board also believes this type of emergency situation is important for radar control trainees in the terminal option; the FAA states that such training is not now provided at the RTF.

When the Pawling Radar controller issued the 50-degree left turn for 86J, she in essence issued an altitude of 3,000 feet by not correcting MON58 when MON58 told

86J to maintain 3,000 feet; the altitude was below the MVA and did not comply with procedures in the ATC handbook. The Safety Board believes the FAA should advise all radar controllers and supervisors currently working in both en route and terminal facilities of the importance of following procedures provided in Paragraph 9-10 of the ATC handbook when providing assistance in emergencies. The FAA should also illustrate the importance of following the ATC handbook procedures by providing information on the accident involving 86J. Finally, the radar controllers and supervisors should also be given training on the proper handling of a VFR pilot in weather difficulty below the MVA or MIA.

The ATC handbook permits vectoring below either the MVA or MIA. Chapter 5, Section 6, "Vectoring," informs the controller to vector aircraft "at or above MVA or the minimum IFR altitude except as authorized for missed approaches, radar approaches, departures, Special VFR and VFR operations," with the following note:

> VFR aircraft not at an altitude assigned by ATC may be vectored at any altitude. It is the responsibility of the pilot to comply with the applicable FAR's.

The Safety Board believes that the latitude afforded by this paragraph allowed the Pawling Radar controller to believe that her actions were acceptable and that the pilot would be providing his own separation from the terrain. The Safety Board does not believe that a pilot lost due to weather difficulty or in darkness with no visible horizon is in a position to safely provide his own separation from terrain. If a VFR pilot is in weather difficulty and notifies air traffic control of his predicament, the pilot is doubtful of his ability to continue flight by VFR. Consequently, a below-MVA vector from an air traffic controller could be dangerous, as it was in this accident. Therefore, the Safety Board believes that any time a below-MVA vector is issued to a VFR aircraft, or an IFR aircraft under emergency conditions, the phrase "Caution, Terrain Clearance Not Provided" should be transmitted to the pilot.

MEAs, MOCAs, MIAs, and MVAs, are all minimum altitudes with which the controller is familiar, and are all either wholly or partly based on terrain. None of them however, give specific elevations or heights of terrain. In 1979, the Safety Board made two recommendations that were intended to increase the amount of assistance that a controller could offer to a pilot. The first was to require all terminal facilities located in designated mountainous areas to install and use emergency obstruction video radar maps (EOVM). The second was to design future ARTCC national airspace system (NAS) stage-A radar systems to include the capability of incorporating EOVMs and to require that facilities serving designated mountainous areas be provided with and use the feature as the new systems became available. The FAA complied with the first recommendation and several controllers have been given awards for providing assistance to aircraft through the use of the EOVM. The FAA did not comply with the second recommendation because the Agency did not consider it feasible to develop an EOVM for the NAS stage-A radar system. However, the FAA stated that the capability to display locally programmed obstruction video maps is an established requirement in the advanced automation system (AAS), which is planned for the mid-1990s. The Safety Board has classified both recommendations as "Closed--Acceptable Action."

In addition to the minimum altitudes already mentioned, there is another altitude, familiar primarily to pilots. The maximum elevation figure (MEF), denoted on sectional charts between lines of latitude and longitude, is based on the highest known feature in each quadrangle, including both terrain and obstructions. Although the MEA, MOCA, MIA, and MVA are all essential for providing an ATC service, the Safety Board believes that for an aircraft in an emergency status, the MEF is the most important information a controller could issue to a pilot because the MEF is always lower in a specific geographical area than the minimum altitudes mentioned above. If an aircraft is in danger of colliding with an obstruction or terrain, the pilot's most important consideration should be the altitude that is required to avoid a collision, which is the MEF. The Safety Board continues to believe that controllers should have equipment capable of providing maximum assistance to aircraft in an emergency status. Until the AAS is implemented and EOVMs are incorporated in the en route system, the Safety Board believes that the FAA should provide the capability to display the MEF to en route controllers via the NAS stage-A radar display. If additional information, such as geographic features or airports, is needed but is not on the radar display, another source of information, such as sectional charts, may be a valuable asset to the controller handling an emergency, and should be readily available.

The Safety Board notes from many investigations that some air traffic controllers are apparently hearing what they expect to hear in transmissions, not what is actually said. In this accident, the Radar South position at Albany Approach had transmitted to MON58, "Boston Center says he might be six miles south of the Grave Intersection which would put him in the vicinity of North Adams Airport and there's also a large mountain peak there, three thousand seven hundred feet. Tell him to use caution." When MON58 relayed this information to 86J, the pilot said that the "...field has a large hump on the field so use caution if you do decide to make a forced landing." The Radar South controller should have noted that 86J was not given all the information intended and should have made sure that MON58 relayed the complete information. The Safety Board is concerned that this type of error--a controller failing to identify an oral error or omission in a pilot's response to a controller's transmission--occurs too frequently. The Safety Board believes that the FAA should remind all controllers that a conscious effort must continually be made to identify and to correct communication errors in the responses that pilots make to controllers' transmissions.

The Safety Board's investigation determined, as a result of interviews with FAA personnel at the Boston Center and Albany Approach, that the supervisors had not taken charge of the situation. Their role was that of an observer. The Safety Board asked the FAA what technical training supervisors receive nationwide regarding their specific responsibilities if they observe either a dangerous situation involving actual traffic or observe an error of a controller working actual traffic. In its written response, the FAA stated that "First-line supervisors are not given any technical training as to their specific responsibilities if they observe a controller make a mistake while that controller is working 'live' traffic, or observes a dangerous situation involving live traffic." The Safety Board believes that supervisors should have a preplanned course of action for the correction of errors or dangerous situations that may occur when actual traffic is being worked. A supervisor should not have to deliberate, for instance, if he or she steps in and works the traffic or gives the controller specific instructions. Key decisions such as these should be made before an actual situation arises. Controllers should likewise have a clear understanding of what action to expect from the supervisor if a dangerous error or situation is noted.

The FAA also replied that the Center for Management Development conducts all supervisory training, and that "role-play" situations address how to handle general performance and correct on-the-job behavior. This training, however, does not address the need to immediately correct errors that create a danger for actual traffic. The FAA also stated that operational position standards for first-line supervisors were being developed. The operational position standards could be used to establish the specific authority and thrust for what a supervisor's response could or should be in a similar situation, and the Center for Management Development would be an excellent place to demonstrate to supervisors appropriate action for situations similar to the one in this accident. Additionally, the Safety Board believes that FAA air traffic management should consider some of the principles developed for cockpit resource management (CRM). FAA Flight Standards has been encouraging all air carriers to incorporate CRM into their flight programs. To improve communication and interaction between supervisors and controllers, the FAA should consider incorporating CRM principles into its training of supervisors.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Require controllers in terminal radar facilities, when assigning a transponder code to a VFR aircraft in an emergency status, to execute computer commands so that the computer-assigned code will not inhibit the minimum safe altitude warning (MSAW) alarm. (Class II, Priority Action)(A-89-110)
>
> Require controllers in terminal radar facilities, when providing emergency assistance to a VFR aircraft that has been assigned a transponder code which allows a computer status change but inhibits the minimum safe altitude warning (MSAW), to change the computer status of that aircraft so that the MSAW alarm feature is not inhibited. (Class II, Priority Action)(A-89-111)
>
> Provide radar control trainees in the en route option at the Radar Training Facility an emergency situation in which a VFR pilot is asking for assistance, is caught in weather, but is below the minimum IFR altitude. (Class II, Priority Action)(A-89-112)
>
> Provide radar control trainees in the terminal option at the Radar Training Facility an emergency situation in which a VFR pilot is asking for assistance, is caught in weather, but is below the minimum vectoring altitude. (Class II, Priority Action) (A-89-113)
>
> Advise all radar controllers and supervisors currently working in en route and terminal facilities of the importance of following procedures provided in paragraph 9-10 of handbook 7110.65, Air Traffic Control, when providing assistance in emergencies; illustrate the importance of following procedures by providing the account of the accident described in this letter (A-89-110 to

-120); and provide training on the proper handling of VFR pilots in weather difficulty below the minimum vectoring altitude or minimum IFR altitude. (Class II, Priority Action)(A-89-114)

Amend handbook 7110.65, Air Traffic Control, paragraph 9-24, "Radar Assistance to VFR Aircraft in Weather Difficulty," by changing the term "minimum safe altitude" to "safe altitude (MEA/MOCA/MVA/MIA)" so that the term does not become confused with "minimum safe altitude" (MSA) as defined in the FAA's Pilot/Controller Glossary. (Class II, Priority Action) (A-89-115)

Amend handbook 7110.65, Air Traffic Control, to require controllers to transmit the phrase "Caution, Terrain Clearance Not Provided" when issuing a vector to a VFR aircraft, or an IFR aircraft under emergency conditions, that is below the minimum vectoring altitude or minimum IFR altitude. (Class II, Priority Action)(A-89-116)

Provide direction and training to all first-line air traffic control supervisors regarding the immediate courses of action that should be taken if they observe a controller under their supervision making an error while working actual traffic that would create a dangerous situation. (Class II, Priority Action)(A-89-117)

Provide the capability of displaying the maximum elevation figure (MEF) to controllers in air route traffic control centers (ARTCC) via the radar display. (Class II, Priority Action)(A-89-118)

Provide information to all air traffic controllers detailing the actions they should expect from first-line supervisors if, in the supervisor's judgment, the controller's actions while working actual traffic have been incorrect and have created a dangerous situation. (Class II, Priority Action)(A-89-119)

Issue a General Notice (GENOT) to all controllers reminding them that a conscious effort must continually be made to identify and correct communication errors that pilots make in response to controllers' transmissions. (Class II, Priority Action)(A-89-120)

KOLSTAD, Acting Chairman, BURNETT, LAUBER, NALL, and DICKINSON, Members, concurred in these recommendations.

James L. Kolstad

By: James L. Kolstad
Acting Chairman

Mr. MINETA. Ambassador Newman, I'd like to ask you a couple of questions regarding Mr. Kelley's testimony from the NTSB, who mentioned the Tenerife tragedy. I recall that very vividly because it was in my first term here in the Congress and we had 49 people from San Jose, my constituents, who were killed in that accident, including our own city manager from San Jose, Dutch Hammond.

You said something that really bothered me, and that is this example you gave of taxiing to position and holding, and that fact that in the U.S. that means one thing, but in a foreign airport it means something else.

Has there been any kind of effort to try and resolve that difference?

Mr. NEWMAN. Mr. Mineta, I'm reminded of what has occurred in our United States with the metric system. The whole world uses metric except for the United States, by and large. And, as you know, we tried to come to grips with unification unsuccessfully. We were talking about it the other day, and Mr. Kern said that we have been trying to do this for 100 years or so—and that has been true—unsuccessfully, to develop a metric system globally that would be universally understood.

We are now seeing automobiles, as you know, that are a combination of metric and English bolts and nuts. Maybe some day we'll come to total metric utilization globally, because it makes a lot of sense. As a small-town corner druggist—that's my profession in real life—I use metric all the time. Scientifically we use metric all the time. But probably you and I will never see the day when metric will be embraced here in the United States.

Because of that kind of situation where we, in the United States, were the leaders in the aeronautical field—we underwrite almost all of the worldly kinds of supports. ICAO, for example, is supported 25 percent by the United States. We have 163 countries, but the United States is the biggest supporter in ICAO, as it is in most of the United Nations organizations.

In spite of that, the idea that we are going to get together and try and unify any sort of measures, terminology, is probably going to be very, very difficult to get the United States to embrace ICAO language. We were the leaders and we feel that, in the main, we probably have a superior system.

Mr. MINETA. Well, has there been any kind of attempt to—unify the term of "taxi into position and hold." It is pretty common terminology.

Mr. Kern.

Mr. KERN. Yes, sir. I don't think it is a safe assumption to think that this is the world against the United States in this particular case. Of all the members of ICAO, maybe everybody—perhaps every country and the United States—uses the terminology that the United States uses because every sovereign country has the right to file differences. ICAO publishes a number of standards and recommended practices that are kind of minimal standards for the world. There are many differences filed by countries to certification standards, to operational standards, to air traffic and other operating standards.

This issue is something that the United States has chosen not to adopt as our own standard. I don't know what the rest of the world has done, but perhaps there are many, many other countries with the highest volumes of air traffic who do use our phraseology. I'm just raising that because I didn't want the committee to have the opinion——

Mr. MINETA. OK That's fine for the phraseology, but what about the practice as to where the airplane is at the time that pilot gets that command? For the U.S. pilot I assume, from what Ambassador Newman said, our airplane is on the runway ready to throttle up to leave; whereas for a foreign pilot at a foreign airport it means they are still on the taxiway ready before being released to make their turn onto the runway.

Mr. KERN. Yes, sir. I think your understanding is exactly correct. And that could lead to two or more situations. For a foreign air carrier operating in the United States, as an example—and I think Ambassador Newman said it earlier—it might not lead to a hazardous situation because if that carrier received that instruction it would be at the hold short line, but it would cause a delay and some confusion.

The threat, in my mind, would be for a U.S. air carrier operating in some country's airspace that did comply with the ICAO standard and definition receiving that command where a mistake might be made.

Now, in those cases when our U.S.-flagged carriers fly in foreign countries and when other airlines like Avianca fly within the United States, there is a requirement for training on the differences—the differences in air traffic control procedures, the differences in operational procedures—if they exist. I would hope—and I think that differences like this are caught and included in training programs for pilots who do that kind of international flying. That doesn't mean that we shouldn't take a look at the international phraseology and glossary of terms, as I said before, because of the new and expanding industry that is out there today, and work through ICAO when we do work through ICAO continuously to resolve these kinds of issues.

Mr. MINETA. Mr. Chairman, I'd like to turn my attention to the document called "Call to Action," because 1985, as all of you know, was not a good year in aviation history. We kept asking: What's going wrong? What's the problem? Much to his credit, Mr. McArtor called everybody together and said, "Hey, we've got to do something here." and brought together all of the industry people represented and came up with this fine document.

My problem is that we haven't used this as effectively as we should from a FAA regulatory perspective. Maybe the users, maybe the airlines, the pilots, ALPA, whomever, have distributed and used this. But from a regulator's perspective, have you used this like an advisory circular so that it has some teeth to it? Or is it just sort of sent out in the mail and sits on somebody's desk as a nice document that they might look at when there is so much good material in here that ought to be standardized and really ought to be gone over in regular training sessions with air traffic controllers, recurrent training, whatever they go through? Is there any standard format?

Mr. KERN. There are probably three major uses of that document, and we would certainly agree that the time was right to gather those groups together to address these issues once again in total. So we value that document.

In my testimony I mentioned one of the major purposes was to generally raise the awareness among the aviation community. The way we tried to do that was, first of all, to have the conferences and advertise the fact as best we can with our own work force and with the industry and with great participation from the unions and the rest of the industry.

Our dissemination of that document was very wide, as we said earlier, including international—ICAO and other international activities.

The problem of getting people to read it is another thing.

Mr. MINETA. But, Mr. Kern, you haven't even responded to your own recommendations, and that was in what Mr. Kelley referred to in his testimony as NEC016 and stated that within 180 days the FAA should reactivate, call to action with greater emphasis placed on the dissemination of the publication. That was when? When did NEC016 go out?

Mr. KERN. I don't know, sir, when it went out.

Mr. MINETA. What about the next recommendation, NEC017, that the FSDOs would initiate a special emphasis item on en route inspections and check rides of the air carrier flight groups to evaluate pilot communication skills and phraseology?

Mr. KERN. I was just informed that the NEC is the North East Corridor recommendations that came out with one of our safety and efficiency reviews. I don't have the—those actions were taken. We carefully log and track those. Our Office of Aviation Safety has complete reporting on what has happened—the milestones and how we have met them—as a follow-up to our system efficiency and safety evaluations.

I would be happy to supply that for you. I don't have that information with me.

[The information received from Mr. Kern follows:]

ISSUE: NEC 016

The original intent of "A Call to Action," a joint FAA/Industry partnership to improve communications, was to raise the awareness of the aviation community of communication problems that plagued the system. Although we did not specifically reactivate "A Call to Action, we have several other initiatives which have produced the same result--heightened awareness to communication problems in the system. They include:

1. Human Factors Study--a study of controller errors from, most specifically, communications. This group is now meeting on a regular basis with many of the participants from the original "Call to Action" work group in addition to a human factor specialist. The charter of this group is to seek solutions to some of the communication problems that have been identified.

2. Hearback/Readback--Air Traffic and Flight Standards are actively engaged in a rulemaking initiative to correct this problem. The draft NPRM would require pilots to acknowledge certain clearances. In addition, surveys on this subject are designed to continually monitor this problem and make pilots and controllers aware of their involvement in this type of error.

3. Flight Standards has developed a tape/slide presentation and a video on communications that has become a permanent part of their accident prevention program. They are also exploring different avenues to conquer the stuck mike problem.

4. ATS Bulletins--Air Traffic has and will continue on an annual basis to publish a special communications bulletin that will be a mandatory briefing for all operational personnel.

5. National Phraseology Review--Air Traffic has undertaken a review of all phraseology in the appropriate handbooks. This review with all regions participating has been completed, and 40 specific recommendations for changes have been made and commented on. Most of these recommendations will be implemented in the change to FAA Order 7110.65F, effective December 13, 1990.

The Air Traffic Procedures Advisory Committee (ATPAC), an FAA Administrator sponsored committee, consisting of members from user organizations including DOD, recommended to the FAA a joint FAA/industry communication awareness initiative. "A Call to Action" was a result of that recommendation. ATPAC has been satisfied and has closed that recommendation, but continues to monitor the results of that initiative on a industry-wide basis.

In consideration of all the efforts now in place and the continuous activity of the organizations involved, we believe this activity is far more beneficial with long-term positive impacts than that which would be gained from a short-term program. We believe our initiatives exceed the spirit of this recommendation; therefore, we recommend closure of NEC 016.

U.S. Department
of Transportation
**Federal Aviation
Administration**

Office of the Administrator

800 Independence Ave., S.W.
Washington, D.C. 20591

APR 5 1990

The Honorable James L. Kolstad
Chairman, National Transportation
  Safety Board
800 Independence Avenue, SW.
Washington, DC 20594

Dear Mr. Chairman:

This is in further response to Safety Recommendation A-86-33 issued by the Board on May 13, 1986, and supplements our letters dated August 25, 1986, March 31, 1987, and August 6, 1987. This is one of 14 recommendations which resulted from the Board's special investigation of runway incursions at controlled airports in the United States.

A-86-33. Require controllers to obtain a readback for all hold, takeoff, or crossing clearances and for clearances onto an active runway.

FAA Comment. The Federal Aviation Administration (FAA) recognizes that runway incursions represent a safety hazard and has made a concerted effort to implement procedures to comply with the intent of this safety recommendation. Since this safety recommendation was issued, the FAA independently initiated 29 actions aimed at the reduction of runway incursions and has implemented many NTSB safety recommendations on this subject. In 1987, the FAA circulated a National Change Proposal (ATO-320-87-13) containing draft procedures to implement this safety recommendation. Based on the analysis of the comments received from FAA facilities, regions, and headquarters, as well as input from user groups such as the Air Line Pilots Association, the Aircraft Owners and Pilots Association, and the National Business Aircraft Association, the proposed change was rejected. Some of the reasons for rejection were: (1) additional controller/pilot workload; (2) increased frequency congestion; and (3) increased delays. Some commentors suggested that pilot education is an alternative to the proposed procedural change requested by the Safety Board. The consensus was that adoption of the proposal would result in the further congestion of radio frequencies used for issuing other critical air traffic control instructions and clearances which are often at or near capacity. The FAA's decision, based on its evaluation of the procedures in the National

Change Proposal, is that the literal implementation of this safety recommendation would neither enhance safety nor make air traffic procedures more efficient.

The Southern and New England regional offices had implemented additional procedures to require pilots to read back clearances and other control instructions. The FAA evaluated these procedures to determine whether or not reading back all hold, takeoff, or crossing clearances and clearances onto an active runway should be required nationwide. The evaluation indicated that there was no appreciable change in runway incursions and major frequency congestion problems occurred.

At the same time, the FAA evaluated the various actions that were implemented since 1986 to objectively measure the progress made to address the runway incursion problem. In the past 3 years, surface errors/runway incursions have decreased dramatically. In 1987, there was a total of 382 runway incursions--in 1989 there were 198. This reduction represents a 48 percent decrease in runway incursions. This reduction was accomplished without the readback requirement.

As an alternate course of action, the FAA is considering the issuance of a notice of proposed rulemaking proposing to require that pilots acknowledge all ATC clearances and instructions with the aircraft call sign.

I will provide the Board with a copy of any document that may be issued.

Sincerely,

JBBusey

James B. Busey
Administrator

Mr. **Mineta**. Well then, Mr. Kelley, may I ask why you are saying here that the FAA as of now has still not acted on its own recommendation?

Mr. **Kelley**. Yes, sir, Congressman. The system safety and efficiency review of the Northeast Corridor and its associated recommendations were released by the FAA in June of 1989. The two recommendations that you refer to were among many that were identified and published as a result of that review.

Mr. **Mineta**. June of 1989?

Mr. **Kelley**. Yes, sir.

Mr. **Mineta**. And it said within 180 days the FAA should reactivate "Call to Action"?

Mr. **Kelley**. Yes, sir.

Mr. **Mineta**. Six months from June of 1989?

Mr. **Kelley**. That's correct. We requested from the Office of Aviation Safety the status of that recommendation, and we were advised that no action had been taken to date.

As far as recommendation 17, which was for the Flight Standards Service to initiate a special emphasis item for their inspectors when they ride jumpseat and do en route checks to emphasize the need for standard, accurate, complete communication and phraseology between the crews and air traffic control.

We asked the Office of Aviation Safety for the progress and the results of that recommendation, and we were advised that Flight Standards evaluated the recommendation and came to the determination that there was no need to initiate this special emphasis item.

Mr. **Mineta**. How do we balance the safety considerations—and you are driven by safety considerations on NTSB—and the operational requirements on the part of the FAA in terms of being air traffic controllers in that pilot/air traffic control environment? In other words, maybe someone doesn't give back the frequency and so the pilot goes ahead and changes to 120.19 but never reads that back, calls into Chicago Center "United 20 heavy checking in at 300"? Or someone else may say, "Flight level 30,000" or whatever the variation might be? Or you get some clearance cross seeds at 11,000, 250 knots, or whatever, and someone just says, "Roger" and never reads it back? How do we balance this need for safety from your perspective and, on the other hand, from pilot/air traffic control communication on the other?

Mr. **Kelley**. That is a very difficult situation, Congressman, and that is probably why we are all here today trying to address this issue. It is a very difficult situation.

Probably the bottom line is that until we get acceptance by flight crews and controllers to use standard phraseology and terminology, that's the best way to ensure accurate, complete, and understood communications that takes place between controllers and pilots.

Mr. **Mineta**. Let me turn then to Mr. Kern. You mentioned the June, 1989, air traffic management recommendation on air traffic control phraseology. I'm wondering if you could elaborate on these recommendations and on the timetable that you have for implementing them?

Mr. **Owens**. Sure. There were some 40 recommendations—and this is an ongoing effort, but right now there are 40 recommendations that have been made that are currently being reviewed by field facility controllers and the users to make sure that they are on target. When that review is completed, which should be within 30 to 45 days, then we would initiate the action to change our handbooks.

Congressman Mineta, you made a remark about reading back clearances. As I stated earlier, if that were guaranteed that that would, in fact, eliminate the kinds of errors that we deal with, we would embrace that immediately. But, unfortunately——

Mr. **Mineta**. But even when you had clearance to 10,000 altitude and the pilot responds 9,000, and maybe he goes ahead and sets his flight control system to 9,000 instead of 10,000, then where are we?

Mr. **Owens**. Well, we wouldn't see that until——

Mr. **Mineta**. I know you wouldn't see that.

Mr. **Owens** [continuing]. He breaks his altitude. I think right now, with today's technology, the answer lies more in the human factors area, quite frankly. It is in listening. It is in enunciating and being clear in the kinds of direction that a controller is providing. And, on the part of the pilot, it is in strict cockpit discipline, also—paying attention and listening to what is being said, especially when you fly into the areas of Chicago, New York, Atlanta, Los Angeles, Dallas.

There is no room in the United States system for complacency. Almost every place you go to now is busy and requires a lot of attention. I think that's the emphasis. That is the kind of educational process that we are trying to accomplish. That's really what "Call for Action" was all about: it was to heighten awareness of common problems in the communications area.

I think it has achieved that, quite frankly. There are follow-on efforts like phraseology that we just talked about. We also have another working group that is continuing to look at communications problems.

I don't think the effort will ever end because, again, with current technology, I don't think there is a simple answer until we reach a point where technology takes over for a lot of the actions that the human now performs.

Mr. **Mineta**. Then let me turn to Doctor Graeber. Using ASRS, are communication problems surfacing as much more of an issue?

Mr. **Graeber**. Mr. Reynard I think is probably better qualified to answer that question.

Mr. **Reynard**. The subject of information transfer, which is the umbrella that we use in the ASRS database, has consistently been the single biggest category of problems associated with incidents. It has not shown any tendency to grow, but it has consistently been a major factor.

As the database has grown we have gone from 5,000 reports a year up to 36,000 reports a year, and the information transfer category has maintained its relationship in the database as constituting about 40 percent of the issues that arise across the board.

Mr. **Mineta**. You are familiar with "Call to Action"?

Mr. **Reynard**. Yes. As a matter of fact——

Mr. **Mineta**. Using ASRS, are you finding other issues coming up that were not identified in "Call to Action"?

Mr. **Reynard**. No. The "Call to Action" document was quite comprehensive, and it almost sounds self-serving to say that because, to a large extent, the "Call to Action" document was based on ASRS research.

As you look at the "Call to Action" publication, itself, you'll notice a lot of references to ASRS database research, as well as illustrations provided from our incident database.

So, to a large extent, we were a major part of the "Call to Action" effort, and what was said there then is still applicable, and it is still applicable, if you will, in the same size chunks.

Mr. **Mineta**. Very quickly, I'd like to just change to the other area that you have already touched on, Mr. Chairman, and that is what is going to be happening with foreign carriers and this whole issue of the language problems.

ALPA indicates that foreign flight crews have difficulties understanding English, and sometimes maybe the machine gun-like delivery of our air traffic controllers. ALPA also cited that FAA air traffic controllers depart from or have been exempted from some of the ICAO standards. I wonder if you could respond as to why the FAA would want to be exempt from internationally agreed-upon standards.

Mr. **Kern**. I think the differences that ALPA is probably referring to are the kind we talked to earlier—the "taxi into position and hold" type clearance. As I said earlier, I'm not sure that that is the world against the U.S. kind of situation.

But it is certainly an area that, because of the growth in this global transportation network, we should work more with ICAO to get more data and figure out what it is.

We'd be happy to do that.

Mr. **Mineta**. In your testimony you said that—I believe it was last week—you had surveyed air traffic facilities that handled the bulk of foreign carriers and that no significant problems were evident. Did you survey foreign flight crews at that time? And wouldn't they be the people who would be experiencing the problems, and not so much our own air traffic controllers who may be handling a lot of foreign flight crews?

Mr. **Kern**. Yes. We did not survey foreign flight crews. It was a casual, word-of-mouth survey of our own facilities that Mr. Owens and his staff here in Washington initiated—as I said, not a scientific survey at all.

Mr. **Owens**. Could I make just one comment on that, though? While they weren't surveyed, at the major airports where foreign carriers operate there are routine meetings conducted with facility personnel and the pilots of those foreign carriers—chief pilots and those pilots who happen to be in town at the time of the meeting. These kinds of issues are very much discussed at those get-togethers of misunderstandings of the kinds of phraseology that we might have. So it is not that they are abandoned. There is an ongoing dialogue with those organizations to ensure that there is an open line of communications and an understood line of communications.

Mr. **Kern**. There are at least two other things that should be mentioned on these foreign flights. Normally when we initiate regular service, whether it is a U.S. carrier into another country or a foreign-flagged carrier into the United States, it is not uncommon to have a native-speaking navigator on board those airplanes just to make sure things get up and running properly. It is not uncommon to have the FAA principal inspector along on those flights—he may or may not be able to speak the language. These are the kinds of duties that that inspector is looking for—to make sure, again, it is safe and up and running.

The INF Treaty flights we have in and out of the Soviet Union right now have Soviet navigators on board the Air Force airplanes.

So there is a lot of reciprocal kind of activity in this area.

Mr. NEWMAN. Mr. Mineta, I can elaborate on that, also. ICAO has 18 annexes, essentially, that establish their statutes. Annex X is the one that deals with telecommunications, and specifically it is chapter five in Annex X that deals with the subject at hand here.

The United States has requested just three deviations from ICAO language, and if you can give me a couple of minutes I will just share with you the three paragraphs that deal with exemptions to the United States.

> One, the United States will use the term "point" in lieu of "decimal" in stating frequencies. For example, "one twenty-six point five five" on a frequency instead of "one twenty-six decimal five five."
>
> Air route traffic control centers will use "center" rather than "control" in their radio telephone identification. For example, "Washington Center" instead of "Washington Control."
>
> Approach control service units will use "approach control" or "departure control" rather than "approach" in their radio telephone identification. For example, "Washington Approach Control" or "Washington Departure Control."
>
> Air control towers will use "ground control" or "clearance delivery" rather than just "tower" in their radio telephone identification where appropriate to identify ground control services. For example, "Washington Ground Control" or "Washington Clearance Delivery."

And the last paragraph that is requested to be exempted is:

> United States FARs do not require that a continuous airborne guard on VHF frequency 121.5 megahertz be maintained, as is the standard ICAO request that every aircraft maintain a guard on 121.5.

We don't do that in the United States.

That is the total request of exemptions that the United States has made for ICAO deviation from standards. It is not really a great deviation.

Mr. MINETA. Doctor Foushee of course, we miss you, very much, at NASA-Ames. Maybe you could help enlighten me a little bit about the kind of research you are doing in terms of human factors as it relates to this communications problem.

Mr. FOUSHEE. Mr. Kern, in his statement, alluded to several steps we have taken to try to address these problems. We certainly agree with the ASRS data that indicate that information transfer problems are perhaps the single-most persistent and difficult problem for us to deal with in the aviation environment.

Many of the difficulties relate to the very richness of language. The chairman, in his statement this morning, mentioned that language has incredible flexibility, but its flexibility also leads to misinterpretation sometimes. That is a basic human problem.

There are technological solutions on the horizon, and datalink has been mentioned this morning as a promising technological solution. However, as with many types of technological solutions or so-called automation solutions, we have to be very careful that we don't, in our attempts to cure old problems, create new problems.

It was also mentioned this morning that one of the things that is useful about verbal communication is that a pilot flying into a busy terminal area has a party line. He or she can hear what other traffic is doing in that environment and develops a very accurate mental model of that particular traffic environment.

We want to make sure, for example, with the use of datalink, that that party line is not taken away.

Another human performance issue relating to datalink technology is that very often humans have the ability to use information on the verbal channel and on the auditory channel simultaneously. If we move all communications to a datalink channel, we want to make sure we don't overload the visual part of the system and cause pilots to miss important visual information in other parts of the operation of the aircraft.

So there are many issues that remain to be addressed and further researched, and our national plan is an attempt to work with the community and NASA and DOD—and certainly the academic community—to begin to frame what the significant operational questions are and invest the appropriate amount of research resources to address them.

Mr. MINETA. Well, I want to thank all of you for your testimony. I was just doing a little bit of "back of the envelope" calculation here. I probably do about 40 trans-continental flights between Dulles and the 13th Congressional District in California, and probably spend about two hours per flight in the cockpit listening with the crews and listening and talking to them about how they feel about air traffic control.

I'd say overall they are very, very pleased with it. Sure, they are a little perplexed with the overload, with the training, the fact that we don't have enough of our air traffic controllers at FPL status. But at least we know our numbers are growing in terms of air traffic controllers coming on board. I think, overall, everyone is satisfied with it. But the problem is that it is that little percentage that becomes the problem area. I think that is what the purpose of these hearings is: to try to get at those areas and see where we can make sure we are improving the system.

Again, I thank you, Mr. Chairman, for the indulgence of your time on this on my part. I will, in fact, yield back the balance of my time. [Laughter.]

Thank you, Mr. Chairman.

Mr. OBERSTAR. I thank the gentleman for his always insightful observations and questions.

The gentleman from Pennsylvania, Mr. Kolter.

Mr. KOLTER. No questions, Mr. Chairman.

Mr. OBERSTAR. I have a few questions I'd like to run through.

ALPA, in their upcoming testimony, will suggest that the phrase "minimum fuel" is not suitable terminology—that if a pilot notices the aircraft is running out of fuel you would assume that the pilot would let somebody—if not everybody—know they are going to crash if they can't get down immediately. How do you address that situation? Is there some standard phraseology that is applicable in such a situation?

Mr. **Owens**. The terminology "minimum fuel" in today's air traffic control environment means that there is a potential problem in fuel management that could result in an emergency situation but does not currently exist. It is a watch item. When a pilot advised air traffic control that he has minimum fuel status, it means that he probably cannot take any undue delay in proceeding to his destination. It is not an emergency situation.

If he goes from minimum fuel then to an emergency situation, then it is expected that he would declare an emergency.

Mr. **Oberstar**. Do both pilots and controllers understand when an emergency is at hand?

Mr. **Owens**. They should. Again, Mr. Kern referenced the pilot/controller glossary that defines those terms. In the Air Traffic Controllers' Handbook it is approved phraseology to handle those kinds of emergency situations or potential emergency situations.

Mr. **Oberstar**. Well, it seems in the Avianca situation that they were pointing at each other, and each pilot and controller is saying that it was the other guy's fault.

Mr. **Owens**. Well, the words really were never spoken with Avianca, in reviewing the transcript. There was never an emergency declared. There certainly was an advisory made that there was a fuel management problem. With that advisory, air traffic control started to move that aircraft towards the airport almost immediately as soon as we found out about it. And, in fact, we got them to the airport. He executed the approach and he made a missed approach. After the missed approach, still aware that there was a fuel management problem, the controller asked the pilot if the pilot could take a heading that would take him out 15 miles before coming back in. And that is the kind of thing you would expect an air traffic controller to do without an emergency being declared. He was taking the precaution to find out that that aircraft would have the capability of flying a certain distance and getting back to the airport.

Mr. **Oberstar**. On that particular night were there a number of aircraft that had minimum fuel situations?

Mr. **Owens**. There were several aircraft—I don't know exactly what the number was—who were having fuel management problems.

Mr. **Oberstar**. Is it unusual to have more than one aircraft with minimum fuel conditions at the same time?

Mr. **Owens**. It is. At domestic airports it is a very unusual circumstance. At an international airport, with those kinds of weather conditions, it is not surprising. Unusual, maybe so; but it does happen, again, because of the long distance and the fact that they are generally coming in all at the same time.

Mr. **Oberstar**. Has the FAA considered it necessary to issue, in the wake of Avianca, a heads-up, pay more attention to clarify more effectively for pilots and controllers the precise use of language that triggers the desired and necessary response on the part of both parties?

Mr. **Kern**. Yes. Both Air Traffic and Flight Standards in the FAA have emphasized it to our employees. And in Flight Standards it is our responsibility to then transfer that on to the certificate holders such as Avianca. And in this case we saw no need to change anything. The Avianca route manuals and operations specifications that were in force at the time of the accident clearly indicate and specify the actions the pilot should have taken.

Mr. **Oberstar**. If both pilots and controllers are saying that the other party speaks too fast, then does that suggest that maybe both of them are in the same soup and that both ought to slow down?

Mr. **Kern**. I think there are cases where we are both guilty of it. I, in the past while here in Washington, have received phone calls from pilots departing Chicago complaining about the same thing. I would call Mr. Owens or somebody else in air traffic. They would call up Chicago and tone things down a little bit. Or we talk to the pilot about what may happen.

We talked about datalink a little bit earlier. In fact, at Chicago and Dallas/Fort Worth right now we have a program where a great many of the clearances are given via automated datalink right now, which has reduced the congestion on the frequency and freed it up, as Mr. Owens said, for other safety-related kinds of duties. We are expanding that service to 30 more airports this summer. It is the beginning of the overall datalink program in the international aviation community.

Mr. **Oberstar**. Would you take just a moment and describe the datalink and how it operates and how it reads out in the cockpit?

Mr. **Kern**. There are several kinds right now. In fact, the air carriers have had a datalink of sorts for quite a while for use in delivering their own company messages, maintenance information, and other dispatch-related data, both on small printers and on CRTs. The clearance deliveries we are talking about at Chicago and Dallas automatically distribute the data from the air traffic computer to the company-owned computer. The pilot can then pick up a clearance and dispatch in printed format to take right to the aircraft, rather than having to use the VHF frequency on the ground when they are ready to push back.

Again, not in a scientific survey, but from my own conversations with the companies who use it and the controllers who are involved in it, they indicate that it is running quite fine. I haven't been able to uncover any problems with it. If there are, I would certainly like to know what they are because we do intend to expand this to 30 more airports. We are working on San Francisco right now today, and other high-usage airports will follow the top 30.

Mr. **Oberstar**. Technology is wonderful, and it has great potential for alleviating the particular—at least one aspect of the problem we are reviewing. How does the controller know that the information has been received in the cockpit? Not only received, but communicated to and absorbed by the pilot?

Mr. **Owens**. All we are talking about right now is what we call a pre-departure clearance.

Mr. **Oberstar**. Right.

Mr. **Owens**. The aircraft is still on the ground. So the controller knows he has the clearance because the pilot doesn't ask for another clearance, so the assumption is he has the clearance, and that's okay because that's right.

In Chicago it is just really American and United that are doing it.

How does he know it is correct? Because it is directly-transferred information.

Could there be a problem with it? I guess there could be. Anything mechanical, just like human, has the capability of something going awry. But that was the reason why we started just at two airports to take a look to see if, in fact, it would work consistently without error. And, in fact, it has. That's why we intend to expand it to the other 30 airports, as John said.

Mr. OBERSTAR. You said something just a moment ago—the controller assumes he has the information. There are so many situations in which we make a leap of faith, we assume, we read into, or we think we have heard something that someone else said and that person didn't say it.

Mr. OWENS. That's true. You are in a typical loop now. I don't know how you get out of that necessarily. In this case I believe there is a transponder code involved in the clearance, and the pilot will confirm that transponder code when he gets on the radio. So to follow onto the assumption is that he has the rest of the clearance. Do you know positively, absolutely that he has it verbatim? No. You do assume that. And, as I said, there have been no glitches to this program as of this point in time, and we have been using it now for about nine months I guess from when we started at the first airport.

Mr. OBERSTAR. I think if you looked at the on-the-ground traffic accidents, so many of them occur, in reading traffic reports, when one person assumed the other person was going to do something that that person should have done and didn't do.

Mr. OWENS. That's true. And that falls on the controller, again, not only as the deliverer of the clearance, but his responsibility also is to monitor this situation to ensure that there is compliance to the clearance. So his responsibility is to ensure that everybody is complying.

Mr. OBERSTAR. Mr. Newman, your testimony raises a question with me. You say when foreign crews arrive in the U.S. they are confronted with a non-ICAO ATC environment. Does that mean the U.S. air traffic control system is not following ICAO standards?

Mr. NEWMAN. I think in general they follow the ICAO standards. As I indicated in the radio communications, those very minor deviations from ICAO standards—using "point" instead of "decimal"—that is standard, common terminology here in the United States and it would be, I think, very difficult to change it.

Mr. OBERSTAR. Are foreign crews alerted to those nonstandard terms?

Mr. NEWMAN. Yes, sir. In all of the annexes—I've got one here on chapter five, which is absolutely germane to your discussion, "Aeronautical Service and Radio Telephone"—the last page indicates deviations from all of the different states involved. I just picked out the United States, but each country has deviations on the back of that annex and that chapter that are supposed to be understood by foreign crews that come into that particular environment.

Mr. OBERSTAR. Yes. What are ICAO's emergency procedures? And do they include specifically the use of the word "emergency"? "I am declaring an emergency." "This is an emergency." How does the fuel level matter—how is it communicated so that there is no misunderstanding?

Mr. **Newman**. If I may, Mr. Chairman, I will read from the annex chapter five in direct answer to that direct question.

This is under 5.3.1.1 under chapter Distress and Emergency Radio Telephone Communication Procedures. "Distress and urgency traffic shall comprise all radio telephone messages relative to the distress and urgency conditions respectively"—that means that any emergency, whether it is fuel, engine out, whatever—"Distress and urgency conditions are defined as: (a) distress, a condition of being threatened by serious and/or imminent danger and of requiring immediate assistance; (b) urgency, a condition concerning the safety of an aircraft or other vehicle or of some person on board or within site but which does not require immediate assistance."

The next paragraph, 5.3.1.2, "The radio telephone distress signal MAYDAY and the radio telephone urgency signal PANPAN shall be used at the commencement of the first distress and urgency communication respectively."

Continuing on the next paragraph, 5.3.1.2.1, "At the commencement of any subsequent communication in distress and urgency traffic it shall be permissible to use the radio telephone distress and urgency signals."

So what this says is that at the first contact where the pilot has an emergency he shall say either MAYDAY if it is urgent or PANPAN if it is imminent, and then subsequently he can use that terminology again.

Mr. **Oberstar**. So the question then in a situation is: what judgment was the crew exercising? How did they read their own situation? Was it serious enough to use one of those international distress signals?

Mr. **Newman**. You know, there is a direct reference, in fact, to a fuel problem in that same chapter five. "You would be in a phase of distress if the fuel on board is considered to be exhausted or to be insufficient to enable the aircraft to reach safety."

So there is no room for interpretation. There obviously was direct reference to the fuel requirement.

I might also add that in Avianca's operating procedures there is direct reference to the U.S. emergency procedures specifically as it applies to fuel management, so they had access to both the ICAO procedure and the U.S. procedure.

Mr. **Oberstar**. Thank you.

Doctor Graeber, in your testimony I did not detect a delineation of the number or percentage of your reports that involved pilot/controller communication problems. Do you have that information?

Mr. **Graeber**. I think Mr. Reynard has that information

Mr. **Reynard**. The charts that you have in the testimony allude to those figures. Table one, of course, would refer to controller situations; table two to pilot situations. And they are broken into the subcategories commensurate with the categories in "A Call to Action." That's how we have approached this breakout issue.

Mr. **Oberstar**. Do you feel that the new Human Factors Division that FAA has established is going to be adequate to address effectively the pilot/controller communication problems to the depth and extent that you feel necessary?

Mr. Reynard. Let me refer that to Doctor Graeber first.

Mr. Graeber. We have, of course, only been several months in working with the FAA in developing this national plan. We have been very directly involved in that process with Doctor Foushee. I think we are developing a comprehensive way to look at this issue using NASA's resources where appropriate, using the FAA's resources where appropriate. But it is one of the major focal points of the plans in human factors research. I think the answer is yes.

Mr. Oberstar. Well, I feel very good about the number of initiatives undertaken, the various programs—Cockpit Resource Management, the Advanced Qualification Program, and the Live Oriented Flight Training Datalink. I think those are all movements in the right direction. It seems to me there is a heightened level of awareness of the problem and the need to focus efforts on human factors, awareness and understanding of the use of simulators and computers. It just seems to me that we ought to have an additional element of continual training and retraining and reworking of the pilot/controller communication to make sure they are using standard language, standard phraseology, speaking at reasonable speeds so that they can be readily understood—each group by the other.

And, as in everything else, human activity can operate at a peak level for only a brief period of time and then you start trailing off. When the pressure is not on, you slip. That's why you have to have retraining and, if the FAA will emphasize that periodic retraining effort, that seems to me that we'll be moving in the right direction.

Mr. Boehlert had wanted me to pick up on your comment about the budget request of $17.2 million for human factors research and ask whether that was the amount that you requested or whether that was the amount that you were cut back to by OMB.

Mr. Foushee. That is our fiscal year 1991 request.

Mr. Oberstar. Your own request. You felt that was the adequate number.

Mr. Foushee. Yes.

Mr. Oberstar. I think there will certainly be a willingness on the part of Congress to provide whatever levels of funding are needed and reasonable to enable the agency to address these issue areas. We'll all work together toward that purpose.

[Mr. Kelley's prepared statement appears on p. 145.]

[Mr. Kern's prepared statement appears on p. 158.]

[Mr. Graeber's prepared statement appears on p. 137.]

[Mr. Newman's prepared statement appears on p. 216.]

[Subsequent to the hearing, the following was received from Mr. Newman.]

REPRESENTATIVE OF THE UNITED STATES OF AMERICA
TO THE
INTERNATIONAL CIVIL AVIATION ORGANIZATION

TELEPHONE
(514) 285-8304

SUITE 753
1000 SHERBROOKE STREET WEST
MONTREAL, QUEBEC, CANADA
H3A 3G4

June 18, 1990

The Honorable
James L. Oberstar
Chairman, Subcommittee on Aviation
Public Works and Transportation Committee
House of Representatives
Rayburn House Office Building
Washington, D.C. 20515

Dear Mr. Chairman,

Thank you again for inviting me to testify before the Subcommittee on Aviation of the House Committee on Public Works and Transportation, May 24, 1990. It was a pleasure attempting to assist you and your committee in discerning problems incurred between pilots and controllers in English as a second language.

Your introductory remarks set an excellent tone for the hearing. Your use of foreign languages in reading the participants and audience illustrated the point more dramatically than any opening remarks I've been privileged to witness during my 17 years in Washington, D.C. The fact that you knew what you were saying obviously did not insure that your listeners understood what you were saying. It pointed up that incomplete understanding is incomplete communications. It hit the bullseye.

You asked me specifically what ICAO is doing to teach English to foreigners. This year, ICAO published the second edition of the Manual of Radiotelephony. Its first chapter is a glossary of terms and common abbreviations. It is enclosed for your staff's attention.

Also this year ICAO, in its working paper, C-WP/9090, decided not to take any action on the proposal by New Zealand to amend Annex 10. This New Zealand recommendation would align the ICAO provisions to distress messages with those contained in the International Telecommunications Union (ITU). ICAO wisely decided to maintain a degree of flexibility to the pilot-in-command whereby information elements in a distress message can be transmitted in the order of perceived importance in each distress situation. (Please find paper enclosed.)

ICAO discussion paper #1, related to AN-WP/5859, 2/12/86, also appears to be helpful to your staff. Even though this paper is 4 years old, it still represents the present state of play in regard to radiotelephony speech for international aviation. (It is also enclosed for staff attention.)

Congressman Greg Laughlin also asked if ICAO supported the insurance of the understanding of English in international aeronautical communications. The above reference materials address this concern also. There is no question but that ICAO supports the utilization of English in international pilot/controller communications. However, even though they use it, some countries are sensitive about sovereign rights and the use of their own native languages. What this means is that English is commonly used, but it is not mandated.

Congressman Jim Lightfoot asked if there is a change in attitude between controllers and pilots (post-Avianca crash). There is no study on this, but my subjective response would be "yes". I fly back and forth from Montreal, Canada to Washington, D.C. Montreal controllers are bilingual, but French is the common language spoken in their communications. However, whenever I speak to them in English, they are not only friendly, but seem to be more especially sensitive to my understanding of our communications since the first of the year.

The FAA considers problems between pilots and controllers high on its priority list. They fully support the FAA/Industry and Pilot/Controller Communications Awareness Initiative. Their booklet, Aviation Industry A Call to Action, is enclosed for your staff's interest.

Since returning to Montreal after your hearing, I have started to contact ICAO staff and Council members regarding the enhancement of communications in international aviation. It is my intention to keep you informed of our progress.

Sincerely,

Don Newman

Don M. Newman

cc: Congressman Laughlin
Congressman Lightfoot
remainder of committee

Mr. OBERSTAR. The subcommittee will stand in recess, resuming at 2:00 for the balance of our testimony.

[Recess.]

AFTERNOON SESSION

Mr. OBERSTAR. The subcommittee will resume its sitting.

Our second panel for today consists of Captain Thomas Kreamer, Chairman, Air Traffic Committee of the Air Line Pilots Association; R. Steve Bell, President of the National Air Traffic Controllers Association; and J. Roger Fleming, Senior Vice President, Technical Development and Planning for ATA—Air Transport Association—and their associates.

Let us begin with Captain Kreamer. You may introduce whoever is accompanying you.

TESTIMONY OF CAPT. THOMAS KREAMER, CHAIRMAN, AIR TRAFFIC COMMITTEE, AIR LINE PILOTS ASSOCIATION, USAIR PILOT, ACCOMPANIED BY WARD BAKER, SENIOR STAFF ENGINEER, ENGINEERING AND AIR SAFETY DEPARTMENT; RAY L. SPICKLER, EXECUTIVE VICE PRESIDENT, NATIONAL AIR TRAFFIC CONTROLLERS ASSOCIATION, ACCOMPANIED BY AMY KAUFFMAN, DIRECTOR OF SAFETY AND TECHNOLOGY; J. ROGER FLEMING, SENIOR VICE PRESIDENT, TECHNICAL DEVELOPMENT AND PLANNING, SIR TRANSPORT ASSOCIATION, ACCOMPANIED BY RICHARD HILLMAN, VICE PRESIDENT, FLIGHT OPERATIONS, SYSTEMS AND STANDARDS, CONTINENTAL AIRLINES; AND JOSEPH F. McLAUGHLIN, VICE PRESIDENT, FLYING, USAIR

Captain KREAMER. Thank you, Mr. Chairman.

Good afternoon, Mr. Chairman and members of the subcommittee. I am Captain Tom Kreamer, Chairman of the Air Line Pilots Association Air Traffic Control Committee. With me today is Mr. Ward Baker, the Senior Staff Engineer in our Engineering and Air Safety Department.

ALPA represents the professional interests of over 42,000 pilots who fly for 50 airlines. We appreciate the opportunity to share with you our thoughts on an issue of paramount importance to aviation safety—that is, pilot/controller communications.

Before addressing some specific areas of concern, I would like to provide a general view on the communications issue. As you know, the air traffic control system has always depended heavily upon mutual cooperation between pilots and controllers for successful operation. This concept will not change, even when datalink between ATC and the cockpit is operational.

The communications process we currently use to conduct operations, however, is the most fragile link in our safety chain. While the same procedures and terminology are used countless times in our system, the process is vulnerable and the potential for a breakdown is always present.

The evolution of airline route structures into the hub-and-spoke concept has resulted in very intense communication and information processing demands being placed on both controllers and pilots during the peak activity times at these locations. This, coupled with normal traffic growth, has resulted in an unprecedented demand for increased capacity.

To satisfy this need, a host of capacity-enhancing procedures are now being evaluated. Virtually all of them result in a reduction of existing separation standards, and thus reduce the margin of safety at a time when controllers are required to work to the limit of their capacity.

It is such times when the increased use of terminology and basic communications skills are compromised due to workload and situation dynamics. This type of environment has even extended itself to some en route sectors where capacity is limited due to the sector controller being saturated.

The bottom line, Mr. Chairman, is that we may be creating an operational environment that fosters human factor errors and, in turn, stretches that safety link I referred to a few moments ago to the breaking point.

The first specific item I would like to address is our implementation of the "Call to Action" booklet. This document is a product of the FAA Administrator's Air Traffic Procedures Advisory Committee, more commonly known as ATPAC. This development was a joint effort by all members of the committee—which, incidentally, is composed of representatives from each of the aviation associations in the Washington, DC, area, as well as the three military services.

The primary purpose of the booklet was to create an awareness within the industry of a chronic problem and some actions that may help mitigate its effects. Actually, the booklet was one step in an industry overall communications awareness initiative that also included posters and commitments from the FAA and industry representatives to publicize the program and to widely distribute the booklet to their constituents.

I am happy to say that ALPA was a leader in this initiative. Let me tell you what we did.

First, our Printing Department published all of the booklets and posters used for this entire program. They produced well over 200,000 copies of the publication and posters at a cost to our association of almost $54,000. I do want to acknowledge contributions by the FAA and National Air Traffic Controllers Association that helped reduce this expense.

An article titled "Trouble on the Party Line" was included in the November, 1988, issue of the Air Line Pilot magazine. This article described in detail the communications awareness issue and reviewed the "Call to Action" booklet. I have included a copy of that article with our written statement. Copies of the booklet and posters were sent to virtually our entire air safety structure, asking them to publicize the program to the maximum extent possible. I have also attached a copy of that letter to our statement.

Finally, every member of our association received a personal copy of the booklet as an attachment to a letter from Captain Henry Duffy, our president. In his letter, Captain Duffy clearly pointed out the importance of this program and asked pilots to keep the booklet in their flight kits for future reference.

I assure you, Mr. Chairman, ALPA more than fulfilled our commitment and responsibilities in supporting this program. We continue to do so today as we receive calls from the public for additional copies of the booklet. While we cannot comment on other organizations' support of the program, we were disturbed to hear from a number of controllers that they had never seen or received a copy of the booklet. Perhaps FAA or NATCA could better comment on this point.

The second specific issue I would like to comment on is the FAA's use of human factors expertise in addressing the communications problems. Frankly, we are not aware of any previous significant projects along this line. We were encouraged, however, when the agency convened a meeting of industry representatives on March 6th and 7th for the purpose of examining human factors relating to pilot/controller communications errors. Several experts in this field attended that meeting, and another is scheduled for May 30th and 31st. ALPA will certainly support this activity.

My final specific comment relates to problems of air crews whose second language is English and the special problems they encounter when operating in the United States. I believe I can best address this issue by referring to the discussion paper I have attached to our statement titled "Procedure and Language Problems Encountered by Foreign Crews Flying in USA." This paper was presented at a June, 1984, meeting of the International Federation of Air Line Pilots Associations—IFALPA—Accident Analysis Study Group. I can assure you that the comments in the paper are as germane today as they were then. If anything, the traffic increases and changes in procedures have exacerbated the problems.

I am not sure it is possible for our system to resolve all of the issues presented in the IFALPA paper. What we must do, however, is look at each event individually and determine what can be done to minimize any misunderstanding. The Avianca accident is a classic example of a communications breakdown that can be fixed.

Specifically, air transportation is international in scope and because of this the identification of fuel problems must also be. A Pan American pilot advising Moscow Approach Control should be able to use the same terminology that has the same meaning to the controller as an Aeroflot pilot would use when advising New York controllers of similar fuel problem. Pilots should not have to dig deeply into each country's aeronautical information publications to see what the magic words are that alert controllers to a critical fuel issue. Such terminology should be part of the standard ICAO vocabulary and be accepted by all countries.

While the United States can attempt to make pilots of other nations more aware of the procedures and terminology we use in dealing with low fuel situations, our ability to be successful in this attack is limited, at best. What we need is an international solution that is developed and accepted by the International Civil Aviation Organization, ICAO.

Mr. Chairman, we ask that you use your influence in getting the FAA to submit to ICAO on a priority basis a proposal that would address two points. They would be:

First, development of terminology that would be used by pilots on an international level to advise controllers that they are approaching a limited fuel condition. The U.S. phrase "minimum fuel" may or may not be suitable. Perhaps there is a more easily pronounced phrase for the international community and one that would not have any chance of being incorrectly interpreted by controllers. In any event, we need a clear, concise term that indicates that when an aircraft reaches a destination it cannot accept any delay.

Second, ICAO needs to emphasize to all pilots that when they are asked by controllers how much fuel they have remaining they should respond in minutes until fuel exhaustion. As it stands now, when asked how much fuel is available pilots frequently respond with times to their reserve fuel rather than fuel exhaustion. Because of the wide variety of fuel reserves required by different countries, companies, and pilots, this is not a good response and does not provide controllers the information they need to make operational decisions. Therefore, a common, internationally-accepted response is needed to ensure both sides are working with a common understanding.

In summary, Mr. Chairman, pilot-controller communications is still the most vulnerable link in our national airspace system, and perhaps even on an international basis. We do need to continue our research into problems areas and ensure we correct known problems as soon as they become evident.

This concludes my remarks. I would be happy to answer any questions.

Mr. OBERSTAR. Thank you very much. I am certainly going to come back to the point you raised about minimum fuel and cross-reference that with the testimony we received from ICAO and FAA earlier today.

Next we will hear from Mr. Spickler, speaking on behalf of Mr. Bell.

Mr. SPICKLER. That's correct, Mr. Chairman. My name is Ray Spickler, Executive Vice President of NATCA. With me today is Amy Kauffman, NATCA's Director of Safety and Technology. We do appreciate, as always, the opportunity to appear before your subcommittee. We believe that this is a very important topic and thank you for calling the hearing.

Mr. OBERSTAR. You are very welcome. We are glad to have your very, very important input on this subject.

Mr. SPICKLER. Thank you, sir.

We are all aware of the tragic circumstances surrounding the crash last January of Avianca 52. NATCA has long contended it was a direct result of the English-speaking member of the flight crew not fully understanding established phraseology. It was a lethal mistake, as he did not communicate to controllers the gravity of the fuel situation aboard his doomed aircraft.

Avianca 52 was a cruel interpreter of the demands and fragility of today's pilot/controller communications.

First and foremost, correct phraseology must be used to ensure correct communications. Given the number of aircraft operations that controllers are working today, brevity and precision of communications are indispensable. There is little opportunity to interrogate a pilot—especially if you are handling 20 aircraft at one time and in bad weather. Controllers rely almost exclusively on pilots to inform them of any problems on board the aircraft. This is aviation's division of labor, and we all acknowledge and respect it.

Therefore, it is amazing that while the FAA requires the English-speaking crew member to be knowledgeable of ATC procedures and phraseology, it has no method to ensure compliance. NATCA believes that FAA should rectify this inconsistency in prompt enforcement of these important policies.

Obviously, the FAA is failing to get across the importance of correct phraseology. ALPA and IFALPA suggest that it would make more sense for the FAA to work with ICAO to establish an international standard terminology for limited fuel conditions, and NATCA believes this proposal has great merits.

Given the fact that phraseology is difficult for many foreign pilots, it is equally dumfounding that the FAA does not effectively communicate vital route information to foreign carriers. Foreign pilots invariably have stale preferential route data. Controllers often have to read the new routes two or three times to foreign pilots, and this is extremely time consuming.

NATCA also suggests a program for foreign carriers modeled along one proposed by All Nippon Airlines. It requested that controllers fly with their pilots to explain airspace, procedures, and phraseology. Unfortunately, this project was shelved. NATCA hopes that the subcommittee could influence the FAA to reconsider this proposal.

Let me tell you a little bit about what NATCA has initiated in terms of promoting global communications and cooperation between controllers on an international scale.

Recently we have engaged in the establishment of an International Controller Exchange Program which has as its goals focus on the following communications categories: improved pilot and controller communications, standardized phraseology and radio techniques, clarification of existing procedures and routings, discussion about U.S. traffic management and operational implications affecting international flights, shared information about emerging technologies and procedures impacting international operations, and the exchange of ideas for handling common communication problems.

Some of the benefits we hope to achieve through this program may translate to effective forms of information transfer not only between controllers, but to pilots, as well.

Phraseology for general aviation also warrants improvement since there is no testing requirement for new pilots. They learn through their instructor and by osmosis. Controllers often find themselves engaged in lengthy and piecemeal communications with GA pilots who are often requesting something as simple as a clearance. In the process, overloaded frequencies and controllers are tied up.

Although the Aircraft Owners and Pilots Association is trying to provide phraseology information to its members, it is the FAA which should accept the ultimate responsibility for ensuring that GA pilots have solid phraseology and communication skills before they are certified.

There are some additional quick fixes that can improve pilot/controller communications. The first is a proposed reclassification of airspace designations. The new, simple, single-letter designations would be much easier to understand and to prevent unintentional airspace intrusions. The same logic could be applied to a nationwide taxiway identification system. The system that we have today is byzantine and can lead to runway incursions. The rule of thumb should be to simplify.

One other nagging communication problem is similar call signs such as American 1132, American 1142, and American 1152. It is very easy to confuse a call sign when the phonetics are close to one another. The situation is further complicated by the "hearing what you want to hear" syndrome.

NATCA suggests that airlines monitor their use of call signs—especially at their hub airports—and vary them as much as possible.

Unfortunately, many pilot/controller communication problems cannot be solved so easily. There are bigger problems of staffing and equipment. As Steve Bell said two years ago, "We don't have a Tower of Babel as much as we have too few controllers in our towers, centers and TRACONs." As a former controller at the Kansas City en route Center, I can attest to the sector saturation problem formerly alluded to by Captain Kreamer.

Today we are handling 12 million more operations than in 1981, but with 3,000 fewer FPLs. Prior to the strike there were usually a radar controller, a hand-off controller, and a controller to perform flight data duties. In many cases today there is one controller juggling all three jobs. The impact on communications is severe.

What is extremely puzzling is that before the 1981 strike controllers were told by management that it was unsafe to work a sector alone. This includes situations where there were no flight data strips, inbounds, or talking on the frequencies. Suddenly, on August 3, 1981, everything changed—and for the worse.

Low staffing also determines that the controller has little extra time to communicate or interrogate a pilot on flight conditions. Transmissions are very quick, often in machine-gun bursts, and it is imperative to get as much pertinent information as possible into each communication. Without the phraseology shorthand we could not handle the number of aircraft that we do today.

Equipment is yet another problem. USA Today recently polled our convention and found that only 5 percent of our facility representatives had full confidence in their equipment. Much of this no-confidence was directed towards the communications equipment, some of which dates back to the 1950s. You would be hard pressed to find a controller who is satisfied with present frequencies and coverage. Due to a lack of dual sites, it is often impossible to talk to aircraft in certain areas. The frequencies, too, are bad. They often are too close together, resulting in cross-talk between frequencies, and three is interference, as well.

It is also impossible to create a new airspace sector since there are not enough new frequencies. The FAA and the Federal Communications Commission have to go back to the drawing board and come up with a plan where we can get more frequencies, because we cannot make due nor expand with what we have today.

And what about the controllers' abilities? Every six months a controller is given an over-the-shoulder evaluation of his or her communication skills, including phraseology. However, little is done outside of this routine to better pilot/controller communications. In other words, overall skills are good, but they could be better—and the FAA is not much help.

As the users and providers try to make their way through this communications swamp, the FAA tells us that some technological magic bullets are on the way. But, once again, what about the human factor? For example, datalink is a good concept, which NATCA does support. NATCA is soundly encouraged and supportive of the FAA's Doctor Clayton Foushee's efforts to provide for human factors research integration through emerging technological systems such as the datalink as part of a monumental program to address the human system interface issues evolving from the national airspace system plan. We are anxious to learn the results of this scientific planning group for ATC findings.

Will automation merely shift our communications problem from the oral to the visual? Will datalink cause a reduction in cockpit workload while, at the same time, increasing controller workload? What is the proper mix of oral and visual communications? These and scores of other human factors questions have to be answered, and the FAA has been slow to react to them.

I therefore find it exasperating that 18 months ago I listened to then-Administrator McArtor as he announced the pilot/controller communication awareness initiative, or "Call to Action." This massive education program, to which NATCA contributed, was supposed to improve communications between pilots and controllers. What happened to this campaign? Your guess is as good as mine. Most controllers have never received the "Call to Action" brochure. Most copies are probably still sitting in storage. We can only assume that the FAA's commitment to the program and document was fairly short-lived.

NATCA wants to see the FAA recommit itself to the "Call to Action." The 12 areas of concern expressed in the program are as vital today as they were two years ago, and the concerns have not gone away. The only thing that has gone away has been the program.

While we do continue to support the "Call to Action," and while FAA seems to have let the program die a slow and painful death, we have used our own internal resources to try to keep this effort alive. We have distributed the packages to our membership as part of our convention agenda last month. We have used the topic in several safety conferences and workshops with industry and the pilot community. We have featured recent articles and commentaries in our own publications. We have worked with NASA ASRS to analyze aviation safety reporting system reports of the communications problems.

NATCA has gone beyond the scope of the initial project to assist in reducing operational errors and system deviations caused by communication errors, and we plan to continue to promote this initiative because we believe in its objectives.

In conclusion, NATCA believes that some measures are being taken to improve communications between controllers and pilots, but the FAA's meager actions are dwarfed by the magnitude of the problem. The FAA must rededicate itself to educating the users and providers of the system, and to getting those users—both foreign and domestic—intimately involved in improving pilot/controller communications.

The agency must also realize that as the airspace becomes saturated, so do communications. At times controllers are working too many aircraft, and because of the burden communication invariably suffers.

Thank you very much.

Mr. OBERSTAR. Thank you for those very thoughtful and very helpful comments full of insight into the situation. I sort of have the feeling we should have had this panel's testimony before FAA's, but we'll still be able to make those comparisons and will follow up on these matters.

Mr. SPICKLER. We appreciate that.

Mr. OBERSTAR. We do have a vote in progress on the House floor. This subcommittee will stand in recess for roughly 10 or 12 minutes.

[Recess.]

Mr. LAUGHLIN [assuming Chair]. Mr. Fleming, Please proceed.

Mr. FLEMING. Thank you, Mr. Chairman.

With your permission, I will summarize my statement and ask that the entire document be included in the record.

Mr. LAUGHLIN. We will insert it following the question and answer section.

Mr. FLEMING. Thank you, Mr. Chairman.

I am accompanied this afternoon by Mr. Richard Hillman, Vice President, Flight Operations, Systems and Standards, Continental Airlines; and Mr. Joseph F. McLaughlin, Vice President of Flying, USAir.

ATA and its member airlines recognize that accurate, concise, and effective pilot/controller communications are essential to safe and efficient operation within the national airspace system. The airlines operate each year about 6.3 million scheduled flights, and about 328,000 scheduled flights in international services. Virtually all of these operate under the instrument flight rules in accordance with FAA regulation. Thus, it is apparent that the airlines and their flight crew members have a vital interest in safe, effective pilot/controller communications.

Communications procedures and disciplines are an integral part of the flight training curriculum from the time a pilot begins his or her initial flight training. However, all airline pilots have acquired the basic communications qualifications for operation under the instrument flight rules by the time they start their flying career with an airline.

Subsequent airline training in communications practices deals primarily with reinforcing the need for proper communications discipline, the need to adhere to standard phraseology, and avoiding the mistakes others have already made.

Readback, hearback, and other communications problems that you have heard about earlier today are covered in airline flight crew member training programs in a number of ways. These matters are covered in ground training sessions, they are covered in periodic bulletins that are circulated to crew members, they are incorporated in cockpit resource management programs, and communications functions are also an integral part of line-oriented flight training—LOFT—scenarios that you heard about from Doctor Graeber and Doctor Foushee.

Airlines participate with government and industry groups in seeking to improve pilot and controller communications and eliminating or reducing the sources of communications errors. The most recent government/industry joint program, which you have already heard about, is the "Call to Action" program. I will not reiterate comments that have already been made by Captain Kreamer and others about that program.

We also participate actively with FAA in their readback/feedback program, which is an effort that evolved from the callback program or the "Call to Action" program. It is an attempt to identify specific communications errors and then follow up with the individual who made the error to acquaint him or her with the fact that they did make an error and the apparent reason why. This, of course, is a very labor-intensive process, but we share the opinion of the FAA and others that this is a worthwhile effort.

We also support the NASA/FAA aviation safety reporting system program that you heard about earlier this morning from Doctor Graeber and Mr. Reynard, and we have participated actively with those two agencies in the development of that program.

You are aware, I'm sure, of the two special study reports that have been developed as a result of the ASRS effort by Captain William Neuman dealing primarily with readback and hearback programs. Those are excellent documents.

To those of us who are concerned with issues related to effective communications, technical solutions, including an expanded use of datalink, offer a great deal of promise, and several other persons who have testified today have mentioned those.

While datalink applications do offer promise in reducing some of the most common hearback errors, such as clearances accepted by the wrong crew or altitude assignments that were misunderstood, caution must be exercised. We must be sure that any decision to embrace either printed, hard-copy information in the cockpit or video displays of that information as a means to communicate with the flight crew while airborne must not result in distraction from other essential duties.

These matters are the subject of human factors research, which was described in part by Doctors Graeber and Foushee. On our behalf, we have established an information transfer/datalink human factors working group to develop recommendations in this area. This working group includes air carrier personnel, air traffic controllers, and pilot organization representatives, as well as NASA and the FAA research and development organization.

ATA and its member airlines will continue to strongly support datalink and other related human factors studies as potential contributors to the reduction of communications errors.

Your hearing announcement asked for views on problems resulting from use of English as a second language. The problems associated with use of English as a second language within the United States are not unique, and we must, after all, recognize that even U.S. citizens from different parts of the country sometimes have difficulty understanding each other. I believe you participated in some colloquy this morning yourself with your colleague from New York to that effect.

However, we do strongly support efforts within ICAO to achieve and utilize standard phraseology as a critical element in overcoming some of the communications difficulties associated with pilot/controller communications where the parties do not share the same native language.

I think it should be obvious that U.S. pilots experience similar difficulties operating in some areas outside the United States where the air traffic controllers use another language to control local traffic but use English to control international traffic.

This completes a summary of our statement, Mr. Chairman. We would be happy to answer any questions that you might have at your pleasure, sir.

Mr. LAUGHLIN. Thank you.

Were any other members of the panel going to testify?

Mr. FLEMING. I think we have all read into the record our completed statements.

Mr. LAUGHLIN. Captain Kreamer, you heard earlier today questions I propounded to the earlier panel about English as a second language, and you heard the testimony. It seems to me, with the diversification we have in our country with people that either have Spanish or Czech or German or Russian or Italian or many of the other languages as either their first or second language, that the air controllers ought to be looking in that area for people with those type skills. Do you support that or have any different opinion from your vantage point?

Captain KREAMER. I think it would be very difficult for a controller, an individual controller, to look for that particular problem and identify that problem. I think we have to go a little bit further. Perhaps Mr. Baker may be able to say something about that. This is where we have to really look at a common language, a common terminology in the way we say things within the ATC communications network so everyone is on board and a controller shouldn't have to be extra alert.

An air traffic controller has enough to do, in most cases, in some of these areas, without having to try to identify a problem. I don't know how well-qualified a controller would be to identify a problem such as that. I think we are going to have to look at these human factors studies and look a little but further past that point.

Mr. Baker may have a comment on that.

Mr. BAKER. I assume you are talking about the different languages being available in the ATC facilities—bilingual controllers. Is that what you are talking about there?

Mr. LAUGHLIN. Yes, but I'm not saying that we have to have half the air controllers in the Southwest of the United States with Spanish capability. But what I am saying and suggesting is that it seems to me when we know that in the Southwest United States on international flights a predominant number of those international flights are going to be coming from Spanish-speaking countries from the south, it appears that we should have some Americans that have Spanish as either the first or second language. We ought to be looking for those. And in other parts of the country—the west coast has certainly those of Chinese and Japanese heritage that have those abilities.

As I understood the FAA earlier today, there was no effort to look for people to hire as air controllers that had any second language in their background.

Mr. **Baker**. That is probably true. I think it would be very difficult to figure out where you would draw the line in this. For instance, at New York you are going to have to go out now and hire a Czech-speaking controller, you're going to have a Russian-speaking, Spanish-speaking? The logistics of doing that in places like Los Angeles, San Francisco, and New York where you have such a tremendous mix of international traffic would be very difficult—keeping the skills up, making sure that the dialects and the meanings were the same, and so forth. It is a very, very difficult process to do, and I'm not sure that the problem has really developed enough to say that should be done.

Probably the easiest thing to do would be to enforce the English language aspect of ICAO and do a little bit better job of training there. But I would certainly hate to have the responsibility in the FAA of trying to manage a program like that and keep the skills—and you have people transferring from facility to facility. It is a very difficult task—not an easy one at all.

Mr. **Laughlin**. I understand it may be difficult, but we are talking about safety.

Mr. **Baker**. Yes, sir.

Mr. **Laughlin**. And I'm not suggesting that we have a prescribed program; it just occurs to me the comptroller of the FAA ought to be looking for people to hire other than individuals like me who speak only one language.

Mr. **Baker**. Mr. Spickler here from NATCA might have a word or two on that issue.

Mr. **Spickler**. Mr. Laughlin, I think, first off, that's a problem that pervades our whole society. While we are not members of IFATCA—the International Federation of Air Traffic Controller Associations—the interaction that we have had with those people over the last couple of years has strongly indicated to me that, while many Europeans are fluent in several languages, the United States is pretty much unto itself an English-speaking country. So I think that is a problem with our society, in general.

Secondly, I'm not sure it would create a safer environment. I think certainly it would be desirable to have controllers who had more than one language, but if it got to the situation where you actually had to have a controller travelling—especially with a more obscure language. Say you had a Russian-speaking controller handling a flight from sector to sector in the New York Center as it was inbound to Kennedy, that could be even less of a safe environment; whereas, if you have him run from one sector to another travelling with this aircraft, relaying the clearances that are being told to him by the controller who is actually responsible for the sector, just basically puppetting or mimicking what should be told to the aircraft, I'm not sure that would create a safer environment.

Also, from our interactions with IFATCA, there really seems to be no movement on the part of the air traffic controllers in the other 60 or so member countries to change to something other than

English as the language of common use other than one of the newer members, the Soviet Union, where they do use the Russian language.

Mr. LAUGHLIN. Well, Mr. Spickler, I do understand what you are saying.

I'm also concerned in the area of some of your testimony where you talked about the precision of communications. It seems to me that if we had all our organizations working together to have standard language or terminology or phraseology, that would go a long way toward curing some of the concerns we have heard expressed here today. I want to ask you if you concurred with Mr. Newman, who testified on the earlier panel, when he called some of these things minor deviations. Were you here when he testified about minor deviations?

Mr. SPICKLER. No, I'm sorry, I was not. Mr. Bell was here earlier, and he was, unfortunately, called away. But I think I know—he is referring to minor changes in phraseology between the ICAO phraseology and the FAA's prescribed phraseology for air traffic controllers, I assume.

To be perfectly honest, I can't think of any specific example to quote you where there is a major or minor deviation. I think when you are working in a busy traffic environment you need to have standardization of phraseology to be used. Certainly in the case, if it is an international carrier, NATCA would support moving into the areas where we could look at adopting a standard ICAO phraseology. That was one reason why we are involved with the IFATCA group. We feel that there are differences in the phraseology as between what FAA adopts sometimes and ICAO. I believe you have to have that kind of a situation when you are dealing with international flights.

Mr. LAUGHLIN. If you had standardization of phraseology among all the international groups and the FAA and the controllers, would that eliminate the necessity of having to read back instructions two and three times?

Mr. SPICKLER. To a degree it would help, but you still are going to have heavy accent influences, I think, which was alluded to earlier. It could even happen amongst the English-speaking people in our own country. I know controllers that are on the frequency when I have been in the cockpit riding that sound much different in the Southwest part of the United States, or in the Midwest, where I am from, versus New York. In different areas of the country people speak a little bit differently. But, generally, I have had no problems understanding these folks until you get a heavy foreign language accent influence that is placed on there. I don't know anything to get around that other than just practice in the use of the language.

Mr. LAUGHLIN. That's all the questions I have at this time.

The gentleman from Missouri.

Mr. HANCOCK. I was curious about technology development in this method of communication. For instance, with the way we have computers now that talk to each other, is there anything on the drawing board which would give a printout in the cockpit rather than all the feedback that goes on? I have a pilot's license. I do a little flying—not very much. You know, I would think, especially with the development of HDTV and this type of thing, that some type of communication could be developed in that area. Is there anything on the drawing board?

Captain **Kreamer**. I'll give you a brief description. This is where we were discussing datalink a little earlier. As a matter of fact, my employer uses it more and more. We used it several years ago for our dispatch releases for weather advisories where they can call me and I can just look at a CRT—a small TV screen—and there is everything I need right in front of me. I could communicate that way. This was the forerunner to our new datalink system which is coming on board. The technology is developing every day. That is a good system, and it is going to get better every day.

We cannot use that as our sole system today. We still have the human voice, which we believe is still the fragile link in this system. The datalink is coming. It is an excellent system.

Mr. **Hancock**. Do you have any idea when?

Captain **Kreamer**. I think 1995 is the appropriation date they are looking at right now. It will continue from there for what we are looking for in the future.

Ms. **Kauffman**. Mr. Hancock, if I may, I can also elaborate a little bit about some of the emerging technology for information transfer.

While datalink can be displayed in hard copy, or possibly in the cockpit, there is another vehicle that is going to impact this communication issue, and that is the use of computer-generated synthesized voice. Currently the FAA has plans to test and put into Dallas in the next 30 days the ATIS through datalink and through synthesized voice. That may generate quite a bit of reaction on the part of controllers and pilots—especially since that ATIS transmission—Airport Terminal Information Service—which provides general, introductory, pre-terminal arrival information to pilots inbound to the terminal area, comes over that synthesized voice much slower than controllers are able to provide it.

So there may be some measurable benefit for having that synthesized voice. Because it is a slower transmission, pilots may not have to listen to it two or three times just to get all the information. That is another element of the technology that the FAA is beginning to identify as possible implementation in the system.

Mr. **Hancock**. I don't have any additional questions. Thank you.

Mr. **Oberstar** [resuming Chair]. I was very intrigued by the testimony of Mr. Spickler about the fuel levels, as with Captain Kreamer. The testimony you gave is very different in tone, nature, and substance from that given by the FAA and by ICAO. The ICAO representative went through this very long recitation of those rule-makings and the guidance that is issued—very legalese language. I hope you folks don't have controllers and pilots recite that language when you are in the air. You are out of fuel before you can get through the numerical listing of the rule.

You say that "many pilots were low on fuel," it is not unusual for a controller to hear that phrase. And since the statement "we are low on fuel" is common in your—you are the practitioners of the art. You are the folks who are out there on the firing line on both sides, in the air and on the ground. When a controller heard that, did it ring a MAYDAY signal for him? When a pilot said "we are low on fuel" is that statement accompanied with a kind of urgency of the voice that communicates more than the words, themselves, do?

You can say, "We are low on fuel," and you can say "We Are Low On Fuel," or you can say, "WE ARE LOW ON FUEL." And when you hear that, does that trigger different responses?

Mr. **Spickler**. Sir, as a controller we do have to rely on the nuances that come across on the radio frequency, and it does transmit some of those. I'm not sure the exact wording now that was used by the Avianca—they transmitted it on several different occasions and had basically given the indication that they were getting low on fuel and might need a priority—I think that was a phrase that they had used. From listening to the tapes, though—our representatives listened to the tapes, and they never indicated by voice inflection any sense of urgency, anything that would tip the controller off that this call for being low on fuel was any different from an American or PanAm or anybody else that was in the system that night that had been holding for a long period of time.

Mr. **Oberstar**. Now, if, as Captain Kreamer suggested—and I'll give Captain Kreamer an opportunity to respond in a moment—if that message were communicated, as he suggested, in minutes—"We have five minutes of fuel left. We have six minutes of fuel left." You wouldn't have to scream it, you wouldn't have to whisper it. The words would communicate the impact of the message, it seems to me. I'm just one layman speaking here.

Would that be more clear than two delineations that we have "We are low on fuel"—very vague, general every aircraft is different—and, on the other hand, using MAYDAY or PANPAN or whatever else there is in the ICAO booklet.

Mr. **Spickler**. Speaking with some of our counterparts over in Europe, they are made more aware of the fuel status of the aircraft. That's my understanding. This is what we spoke about in recent instances over here in the United States.

Mr. **Oberstar**. Would expressing it in minutes be a better, more quantifiable——

Mr. **Spickler**. It would depend on the circumstance, I think. Certainly we don't want to be in the position of flying the pilot's airplane. We think it is up to him to make the determination when he is truly fuel critical. I believe that is why the phraseology has been adopted as it is. You have basically two levels: Minimum fuel, where the pilot can accept no undue delays in proceeding to the airport; and emergency fuel, where the pilot must proceed to the airport immediately and land.

Having the information in minutes, in addition to that, would be helpful I think to the controller. But I don't think just having the minutes, alone—then I think you are putting the controller more in the position of having to determine when he must make that aircraft depart a fix in holding to proceed to land.

Mr. **Oberstar**. Captain Kreamer.

Captain **Kreamer**. Yes, Mr. Chairman. These were just recommendations we had. This minimum fuel—and please try to understand that each different country, each international pilot, their inflections and what they mean by those may be totally different than what they pick up from one of our controllers. This recommendation we have the minimum fuel in this country just means "I cannot accept any undue delay." This is the reason we thought, as a recommendation, we'd add the minutes. Perhaps you'd want to say, "Minimum fuel, I have an emergency." The controller may ask you then how much fuel you have remaining. "Well, I have six minutes until fuel exhaustion."

I have found, dealing with most international pilots, they are very calm. That's just the way they react to things. They just don't have that inflection that we may use the way we pronounce things here.

We are going to have to do a lot of work developing the type of phraseology or terminology we use on an international level. And we also have to look at the amount of international flying that is coming into this country, as well as what is going to our international destinations from this country, how we develop this particular terminology and phraseology.

Mr. OBERSTAR. International travel is going to increase.

Captain KREAMER. That is exactly right. There is one thing that we have done, if I may. USAir and Air Line Pilots Association have taken up a program that was sponsored originally by Emery-Riddle Aeronautical University and Eastern Airlines for eight years. This year was the first annual USAir/ALPA/Emery-Riddle Communicating for Safety Seminar. We plan on turning that into an international communicating for safety seminar where controllers, pilots, crew members, dispatchers—everyone involved with communications—would take part in this.

What we would really like is for the FAA to insist so many controllers from each facility will go to this once a year. We feel it won't be an undue financial strain for anyone, and we feel as though we are on the right avenue to help develop a safer environment for crews, for controllers, for everyone. It is just another step in trying to reach a better understanding of communications. This will apply to phraseology, human factors, terminology, the ATC system.

Mr. OBERSTAR. Mr. Baker.

Mr. BAKER. Getting back to this minimum fuel issue here, there is nothing in the ICAO documents that approximates or equates to the term we use in the United States here that is an advisory that a pilot will use prior to reaching an emergency condition.

Now, in each one of the ICAO documents that the gentleman from ICAO referred to this morning, on the first few pages there is a lexicon of terms—something similar to our pilot/controller glossary that Mr. Kern referred to. But no place in there is there any common phrase that addresses the same thing as our "minimum fuel" in the United States means. What we were suggesting is that certainly there has got to be some accepted term in the international community that addresses that issue that will let the pilot advise the controller without having to take that emergency step that's meaningful.

Then, if a controller comes back and says, "Well, how much fuel do you have left?" As Captain Kreamer said, "I've got 30 minutes. I've got 10 minutes." He can plan his operation. As it stands now there is no criteria. You have reserve fuel that a pilot may say, "Well, I'm going to have this 30,000 pounds. I'm not going to tell them about that." But the next guy right behind him might truly only have ten minutes of fuel, and he's the one that should get priority.

So those were the two points we're trying to make. You need to have an international standard. The international community has got to feel that they are part of the solution because we don't have the surveillance capability—the FAA, with their manning and so forth—to get out and really work with a lot of these foreign carriers to make sure their training programs are incorporating all that stuff.

Mr. **Oberstar**. Did you feel comforted by what Mr. Kern and his associates said this morning?

Mr. **Baker**. I don't think they really addressed the point that we were trying to make in our testimony.

Mr. **Oberstar**. They certainly didn't address the questions that I asked on this very subject in the way that you have.

Mr. **Baker**. You really need to get something. Any line pilot flying for Air Avianca or Aeroflot or anything else should be able to pick up that ICAO document and see that minimum fuel means the same thing here as it does over there, and if I say that the controllers everywhere are going to know what it means. They have done that with a lot of other phrases in the front of those ICAO publications. What in the world could be more important than that fuel advisory? That is a killer. It certainly ought to be in there someplace.

Mr. **Oberstar**. Have ALPA and has NATCA made recommendations to FAA specifically along the lines you have just suggested?

Mr. **Baker**. No, sir. We have not submitted anything yet because we did not want to preempt or pre-judge any of the investigation ongoing with Avianca and so forth, but we certainly intended to do that. But you called this hearing, and this is an opportune time to throw it open for public discussion.

Mr. **Oberstar**. I think at least this chairman may make that recommendation to the FAA because it seems eminently sensible to me, and make the same recommendation to ICAO. There is no reason for them not to have a clear, understandable terminology that everybody can understand—controllers and pilots, domestic and foreign, alike, entering our airspace. It should be no different, as one of you said here, whether you are an American pilot entering Soviet airspace or the Soviet pilot entering U.S. airspace.

Now, having said that in somewhat slow motion fashion compared to controller talk, do pilots think that controllers ought to talk slower, and do controllers think that pilots ought to talk slower?

Captain **Kreamer**. Do you want Ray to answer that or me? [Laughter.]

Mr. **Oberstar**. I'll give you the first shot.

Captain **Kreamer**. Of course, I operate in the United States 99 percent of the time. My international flying is usually associated with Canada, so it is the same language, more or less.

I don't have the problems understanding the controller since I am used to this environment here and the terms here. However, you can pretty well tell when you get into a saturated area of airspace—saturated or en route or terminal—when the controller is very busy. They do tend to speak very rapidly, and that's when we have to ask for readbacks to clarify clearance. And, of course, when you have to clarify clearance, you are adding a little bit of strain to the system.

Mr. Spickler. I would agree with that. More than likely, I think in most cases it is the controller who has to speak more quickly in order to keep up with the workload of the sector. And there are even times I, myself, at times have had to just give out clearances to aircraft asking them not to respond verbally to the clearance but to acknowledge with an identification signal that they can use with their transponder—an IDENT, we call it. It changes the look of the beacon slash. You tend not do to that with very important clearances—altitudes, routes, things of that nature—but things of a more routine nature when you get into a busy sector

Weather, as you know, heavily impacts our workload. Things get balled up, and so you just have to get things out as fast as you can. And that is something that we try to train people to watch out for, because if you get into that mode and you are speaking quickly, then exactly what Captain Kreamer said will happen: the pilots will have to ask you to read back. That slows you down even more.

Mr. Oberstar. It has been a little space of time since I have been in a center observing operations, but I know that generally a controller is considered to be busy when he has got 27 or 28 aircraft on his screen, and I assume that is probably, even with the new technology, even with host computers on-line, even with the new people that have come on board, is still a busy time. You've got those aircraft and you've got to be moving them. Now, that is an en route center. I'm not talking about a tower or TRACON. You've got to fire information pretty fast, don't you?

Mr. Spickler. Yes, you do. And really what you said is totally accurate. The host computer hasn't really—it has been fairly invisible to the controller other than the system has been more reliable in the en route centers under the host. And the ISSS—the sector suites—that are coming on line, when they are initially installed and for a period of time thereafter it will be a new console to work with and it will be nice and shiny and maybe give a little bit more information, but basically the controller will be having to do the same types of things.

Mr. Oberstar. So imagine that situation and hearken back to Mr. Kern's testimony earlier today in which, in response to my question, he said, "Well, we surveyed our controllers and they don't have any particular trouble with non-English-speaking pilots because they pay special attention to them."

Mr. Spickler. My exposure was limited, working in Kansas City, to primarily Mexicana flights coming up. I hate to identify one airline, but that was primarily the only one that I noticed that I worked on a regular basis—primarily routes flying from Dallas to Chicago. Some of them spoke very good English and some spoke very broken English. It would just depend upon the ability of the pilot.

So I think that it is a problem for us to deal with and it doesn't—of course, you have to listen more carefully if you have someone who is not speaking English very well. That does go without saying. But it doesn't get rid of the problem.

Mr. OBERSTAR. When you are in that situation—you are a tower controller or an approach controller—you don't have time to run to your book and see if you are using ICAO's standard language here for this pilot coming in from overseas someplace, and is he going to understand me? You use what instinctively comes to mind from your training; correct?

Mr. SPICKLER. Yes, we do.

Mr. OBERSTAR. And you assume or you rely on the pilot to understand that language, right?

Mr. SPICKLER. Yes.

Mr. OBERSTAR. So the standardization has to be applicable both to pilots and controllers.

There was a statement in the Battelle study that reported their findings that a substantial number of controllers are handling too much traffic or traffic mixes that are too complex. You said a little while ago that controllers are handling 12 million more operations a year than they did in 1981 with fewer FPLs. That information together sounds shockingly familiar to findings of this subcommittee and the Investigations and Oversight Subcommittee in 1980 and early 1981. Are you concerned about the direction in which you are headed?

Mr. SPICKLER. I am concerned that it is nine years now since 1981 and we are still 3,000 journeymen short from what we had at that time. I am not sure—I don't believe that the agency intends to reach that level of FPLs again in the system. If they did truly intend it, I think it could have been achieved by now. Certainly we have talked about training with your committee before and other issues along these lines where there have been problems, but it seems like if it was properly done, if that was the goal, it was achievable in a nine-year period of time.

I can certainly attest that I worked a one-man sector many times, as I'm sure the controllers working up in your district and up in Minneapolis work one-man sectors a lot of the time in order to be able to get a break to go have a bite to eat, or something along those lines, and come back in to work the traffic as soon as you can. It is a problem, and you do tend to—a controller gets trained and has a comfortable level where he is doing quite a few things one after another and you get into a nice, little routine—a rhythm that feels comfortable. Below that it can be boring, but if you get above that then the controller has to start diverting his attention away from some things in order to concentrate on the more important matters that must be dealt with. That's where the breakdown is going to start to come. So staffing does play a major factor.

Mr. OBERSTAR. It sure does. I think that's a matter to which we are going to have to turn our attention very soon.

Now, Mr. Fleming, I would like to get your views on the training aspect of this human factors issue. What amount of training does ATA consider—speaking for the carriers—adequate for pilot training to communicate effectively with controllers?

Mr. FLEMING. Mr. Chairman, if I might, I'd like to have Mr. Hillman and Mr. McLaughlin, in turn, respond to your question. They both are responsible for training and standardization activities in their respective airlines.

Mr. Hillman.

Mr. **Hillman**. Yes, Mr. Chairman. As Mr. Fleming stated in his opening statement, the pilot we hire is already a fully-qualified commercial aviator and has basic knowledge of communication procedures. At Continental—and I'm sure we are not that much different from the other carriers—he will undergo a basic indoctrination training as a new pilot with us which will include modules on air traffic control and communications procedures.

We are very actively engaged in crew resource management programs which we started about five years ago. The new-hire pilot goes through our two-day seminar, and a good 30 percent of that is devoted to active listening and communication skills, because we feel that is very, very important within the cockpit as well as without the cockpit.

Mr. **Oberstar**. In the course of that simulator training is a pilot who is going to be flying an international route exposed to controller communication from another country with a different accent in the English language? For example, if you are going to be flying into France, and that's the first time for this pilot, is he going to get some exposure in a simulator or in a tape recorder to what those controllers are going to sound like when he hits France?

Mr. **Hillman**. Unfortunately, not in the simulator. In fact, the AQP—the Advanced Qualification Program—that Mr. Kern alluded to will probably allow an airline to develop more meaningful training, but under today's simulator training we are pretty well restricted to having to perform certain maneuvers within a certain period of time.

The check airman, however, in administering both training and check rides in the simulator, are required at Continental to communicate with a microphone through the inter-phone system. They are issued excerpts from the Air Traffic Controller Handbook when they receive their initial certification training to be a check airman, and in their annual certification they are tested on this so that they must use proper phraseology.

The way to handle the international—at this stage, of course, the pilot will receive some initial operating experience with the check airman in the cockpit on an actual flight, and that check airman will be very familiar with the foreign airport operations.

We also have area qualification programs, which are handouts and videotapes that cover the intricacies of a certain geographical area. We have them for the North Pacific, North Atlantic, Latin America, and Caribbean.

But as far as simulator training we are not at the point now where we are doing that specifically for that kind of training.

Mr. **Oberstar**. In my years of teaching foreign language, using tape recorders and a language laboratory—very inexpensive as compared to simulator training, which can run up to $300 or $400 or $600 an hour—you don't need anything terribly elaborate, but voices so that you attune your ear to the sound.

I plugged in when I was with the Presidential Commission on Aviation Security and Terrorism inquiry in Europe in German airspace and French airspace and listened to German controllers. Now, my ear is very good at picking up curious pronunciations, and one of the sound systems that you are attuned to with the German language is the "th" diphthong. They have a very difficult time making "thing," "thirty," "think." They haven't got their tongue in the right place and it comes out with an "S" sound. It is just a simple mechanical factor.

Getting accustomed to that would make a lot more sense on the ground before you get in the plane before you are in the airspace, than to have to be in that airspace and try to figure out what this guy is saying to you when you are performing a lot of other operations that are very critical at that particular moment.

Mr. **Hillman**. And that seems to be very do-able. That could be done with tape recordings and that kind of a—I don't see it necessarily in the simulator, but I could see use in the classroom or some kind of orientation.

Mr. **Oberstar**. Yes. Something much less elaborate than a simulator. But that is not now necessarily being done?

Mr. **Hillman**. It is not at Continental.

Mr. **Oberstar**. There is no exposure to pilots in a training environment of accents that they will encounter flying in other countries?

Mr. **Hillman**. Not specific accents. They are definitely briefed, and we have these individual airport pages for every airport we operate into that you can read. It will say, when going into Mexico, "The Mexican controllers will speak English; however, it will be broken and difficult to understand. If you are not clear on what they say, request a readback." Those kinds of instructions are passed on, but no specific——

Mr. **Oberstar**. And are pilots then also trained to recognize the international or the ICAO language—"decimal" instead of "point," for example?

Mr. **Hillman**. That is part of our area orientation. I know, for instance, on the Orly Paris—10-7 page we call it in our Jepson Manual, which is a page that Continental develops for every airport—there are things such as that they may be "cleared to land after" instead of "cleared to land," which is something they use at Orly which means there is an airplane still on the runway and "you are cleared to mean after" means if, in your opinion, he has cleared the active runway you are cleared to land. There are those kinds of differences. We print those on this page, which the pilot reviews within an hour or so of destination. He looks and sees what he has to be aware of going into Orly. We try to cover those things.

Mr. **Oberstar**. Does it make sense to have those differences? Mr. McLaughlin, how do you feel about that?

Mr. **McLaughlin**. Well, we do that a little bit in our international training. We have a tape recording of an ATC conversation with a USAir airplane and an English air traffic controller just to show the differences between air traffic control procedures.

But, since we are going to England—that was our primary route—it wasn't mainly to show the differences in accent, more in the differences in ATC procedures and terminologies.

Mr. **Oberstar**. How do you feel about different terminology in European airspace than that used in the U.S. airspace?

Mr. **McLaughlin**. It is certainly a problem. I would rather see standardized language throughout the world to make it much easier for pilots and controllers to communicate. That's obvious. So

I think we should work towards that. If anything comes out of this, it should be a standardized language and standardized procedures.

Mr. **Oberstar**. You know that when a foreign vessel enters the Saint Lawrence Seaway and begins its voyage in the Great Lakes a U.S. pilot boards that vessel to guide that vessel throughout the three sections. There is one pilot in the lower lakes, one pilot in the middle lakes, and a different pilot for Lake Superior. Those pilots know the shoals, they know the water, they know the wind, they know the temperature differentials, they know just how much leeway they have in the Saint Mary's river, they know they can't use LORAN-C because it doesn't give them enough guidance on a 120-foot channel and it is good to only 50 feet, they know they have to use the fixed navigational buoys.

And no matter how many times over a career a Dutch pilot has been into the Great Lakes, he doesn't know their waters. Those pilots do. They guide them through. They know our language. They know the terminology when they are talking on the radio to shoreside.

You can't quite do that with airplanes. They can't board that aircraft at 30,000 feet when it is coming into U.S. airspace and put a U.S. pilot on board who knows our—the only other option is either you standardize the language or put a U.S. pilot on board who takes over when they enter U.S. airspace, or vice versa when our aircraft enter foreign airspace. That doesn't make too much sense, does it? Standardize the language.

I would think that ATA and the carriers would be beating on ICAO's door to do that and on the FAA's door.

Does the FAA have training for controllers in the same way that I suggested to pick up for those who are working airports that have heavy international travel? Do you have that kind of training to acclimatize your ears to the dulcet tones of foreign accents?

Mr. **Spickler**. Not to the best of my knowledge, Mr. Chairman.

Mr. **Oberstar**. So you just have to sort of pick your way through what they are saying and make them repeat if you don't understand?

Mr. **Spickler**. That's the way—I've never seen any training on it. Ms. Kauffman has a comment. Maybe she has something to add on that.

Ms. **Kauffman**. No. Officially no. But I'd like to make a point that touches on your emphasis about the language issue and the enunciation and the pilot, if you can indulge me for one minute.

We went to the FAA as part of the "Call to Action" activity as a joint industry. Individual organizations went back to some of their people in the "Back to Basics" program and asked them to fund exactly what you asked for. This would be a videotape which has little out-takes, if you will. Those out-takes included each of the 12 areas.

The interesting piece of that proposal was the international enunciation question where we had air traffic control tapes from New York, Alaska, San Francisco, Los Angeles, and Miami that were absolutely incredible in terms of humor when you think of some of these things happening in the system. It is funny, but it is a very graphic way of showing what possible things can happen.

That was not funded. Because of the timing of this program the funds weren't made available. One of the appeals that I have to you, sir, would be to help the FAA direct them into funding these kinds of activities towards supporting this "Call to Action."

Another issue about whether the controller can take the time to address and cater to the international pilot, the pilot that has an inflection or the pilot that has an enunciation or pronunciation issue procedure, I have to bring our attention back to the staffing issue. If we are working one sector, a combined position, or the position isn't staffed, the guy may be lucky enough to be on a break, or what have you, that staffing issue goes right back to the root of the problem. We're not saying that is going to solve these hearback, readback, or enunciation problems, but it sure does make it a heck of a lot easier for a controller to spend the time he might need to take with a specific flight coming inbound or departing to handle that foreign language issue. If the positions were staffed appropriately he might have a little bit more time to take that attention that is required.

Mr. Oberstar. I agree with that. That makes good sense. That's why I raised the question earlier of staffing levels and volume of work load.

Ms. Kauffman. I was trying to kick him under the table to see if I could interrupt there a minute.

Mr. Oberstar. Don't ever hesitate. Don't be shy. I appreciate what you are saying about the conversation that may even, in retrospect, appear humorous. But it might be a kind of gallows humor.

Ms. Kauffman. It had a lot of potential. We felt it had a lot of potential. And the issue that we got in response from the FAA was, "We think it is a good idea, too, but we don't have the money to fund that kind of initiative."

Mr. Oberstar. Well, I think that we should make it a point to see if we can encourage FAA funding, as you have suggested, and we will bend an effort in that direction.

I want to compliment ALPA on your efforts in distributing the "Call to Action" and your article in your magazine, "Trouble on the Party Line"; and ATA in your efforts in the training area. I call your attention to moving further in that direction of training to understand the peculiarities of other tongues speaking our language. And we'll make it a point that the FAA pays closer attention to and gives greater effort in this area in which there seems to be a shortcoming, and one that I feel they may not have given enough attention to.

Any other comments any of you want to make, or observations? Yes, Mr. Fleming.

Mr. Fleming. Thank you, Mr. Chairman. Following up on the comments by Amy Kauffman, I think we in the airline community feel that training of air traffic controllers has been an issue for years because training is the bottleneck that has resulted in not enough full performance level controllers on the job, and that produces some of the kinds of difficulties that have been referred to by Mr. Spickler and Ms. Kauffman.

We would urge, Mr. Chairman, that FAA be asked to look into the application of more advanced training techniques to try and break this logjam to deal with a whole set of training issues, not just the one that you are treating this afternoon.

Within the airline community—I think helped by NASA and the pilots and the enthusiastic participation by FAA, also—we have adopted what we think are very advanced training techniques. You heard about several of them today—line-oriented flight training, cockpit resource management, advanced qualification program. Those are the set of acronyms that are used by FAA and the airlines to characterize those programs.

I don't believe that the agency has come close to matching the progress that is made in the industry in terms of providing the most sophisticated, advanced training for air traffic controllers, either for their initial qualification or for recurrent qualification. We believe that is an area that would merit your investigation and that there would be some very productive changes that could be made if FAA could be moved further down the road towards new training applications. At the same time, we must all recognize that those training applications don't come cheap and funds will have to be found for those kinds of programs. But we certainly would support the need to accelerate that training cycle so that the controller work force has got a higher FPL population.

Thank you.

Mr. **Oberstar**. I fully concur on that viewpoint.

We'll give you an opportunity to return to this table at another date when the committee will hold hearings on the adequacy of the air traffic control work force.

Thank you very much for your testimony. We greatly appreciate your presence here today and the effort you took to deliver those remarks.

[Capt. Kreamer's prepared statement appears on p. 188.]

[Mr. Spickler's prepared statement appears on p. 222.]

[Mr. Fleming's prepared statement appears on p. 129.]

Mr. **Oberstar**. Our last panel is the Association of Professional Flight Attendants, represented by Cheryle Leon, accompanied by Kelley Coyner.

Welcome. Thank you for being with us today. As always, we appreciate the presentation of the flight attendants at our hearings on aviation matters, and we respect enormously the very special role in safety that flight attendants perform aboard aircraft.

Please proceed.

TESTIMONY OF CHERYLE LEON, PRESIDENT, ASSOCIATION OF PROFESSIONAL FLIGHT ATTENDANTS, AMERICAN AIRLINES, ACCOMPANIED BY KELLEY COYNER

Ms. **Leon**. Mr. Chairman and members of the committee, I am Cheryle Leon, President of the Association of Professional Flight Attendants. APFA represents over 18,000 flight attendants who fly both in the United States and overseas for American airlines. We welcome the opportunity to testify before you today on the critical safety issue of flight communications between crews and passengers and among crew, and we are most appreciative, Mr. Chairman, of your longstanding leadership on issues of airline safety.

I am here today to discuss the increasing threat to airline passenger safety resulting from extensive use of foreign nationals who are not fluent in English. Because English is the first language of most cockpit crew on U.S. airlines, flight attendants must be able to speak English. Clear communication in English among crew takes on critical significance during an emergency.

In the past several weeks American and APFA have been negotiating over the use of foreign national flight attendants on many flights between Latin American and U.S. gateway cities. American recently received approval to assume Eastern Airlines' Latin American routes, and American has proposed to use 100 percent foreign nationals for the crews on many of these flights.

Presently, no other carrier, including Eastern, follows such an extensive practice of employing foreign nationals on U.S.-flagged carriers. Even Eastern limits the number of foreign nationals and the use of foreign nationals on flights which touch the U.S.

There is no current Federal requirement that flight attendants be proficient in English. The inability of foreign flight attendants to speak fluent English is a serious threat to passenger safety. First, flight attendants need to speak English in order to communicate with cockpit crews. Those cockpit crews are U.S. citizens, and their first language is English. Indeed, the FAA requires all pilots, navigators, and flight engineers to be proficient in both spoken and written English.

It is essential that all flight attendants be able to communicate with cockpit crew and passengers quickly and clearly. Flight attendants are responsible for evacuating aircraft during post-crash fires, detecting and extinguishing in-flight fires, protecting passengers in explosive decompressions, and treating passengers with inflight medical emergencies.

In an era of heightened concern over terrorist activities on airlines, flight attendants are charged with monitoring the aircraft for bombs and managing the cabin during a highjacking.

One of my own experiences as a senior flight attendant illustrates the importance of communication between cockpit crew and flight attendant crew. Several years ago, while serving as a senior flight attendant on a flight from Chicago to Los Angeles, one of the passengers became unruly in the course of the flight. This individual had smuggled a large quantity of alcohol into the aircraft and was mentally unstable.

A flight attendant requested assistance from the cockpit crew in controlling this passenger. The flight engineer responded to the request and ran headlong into the passenger's fists. The flight engineer was knocked unconscious and suffered a broken collarbone.

FAA regulations and company policy provide very strict instructions for what steps must be taken when a cockpit crew member is incapacitated in this way. It was the flight attendant's responsibility to communicate to the cockpit crew accurate information to allow them to ascertain how much longer the aircraft was permitted to fly, where it could land, and what assistance this incapacitated crew member required. In the heat of the moment it was imperative that I was able to communicate with the pilots.

The ability to communicate effectively in English is particularly critical during takeoff. Generally, flight attendants avoid contact with the cockpit until the aircraft is airborne. Communication with the cockpit during takeoff is difficult, at best, because of the extremely high noise level for some aircraft and due to full engine thrust for take-off and the relatively poor quality of some aircraft earphones. Nevertheless, if a flight attendant observes an emergency such as an engine fire, he or she must immediately contact the cockpit, giving clear and succinct information.

Precious seconds are lost if the pilot must ask for the information to be repeated—precious seconds that could determine whether the pilot still has enough time to abort take-off or must lift the aircraft off the runway.

Flight attendants must obviously also be capable of communicating with passengers during an emergency. It is true that a larger number of passengers may not speak English—particularly on flights from foreign points into the United States. The answer is to hire flight attendants who are both fluent in English and in the language of the passengers.

APFA's contract with American currently recognizes this need by specifying that the airline may assign a certain number of flight attendants on each international flight who are able to speak in the language of the foreign country of origin or destination.

To respond to the foreign language needs of passengers through extensive staffing with foreign national flight attendants would be to court disaster. American and APFA are presently engaged in negotiations to address this critical concern.

We call on the Federal Aviation Administration to investigate this issue and to take whatever regulatory steps are needed to ensure that all flight crew, including flight attendants, are proficient in English, if necessary, and if the FAA lacks either the statutory authority or willingness to act, this committee may wish to consider adopting appropriate legislative measures to require that all flight crew are proficient in English so that the safety of crew and passengers is protected.

Thank you for your time. I would welcome any questions.

Mr. OBERSTAR. Well, thank you very much for your presentation and for addressing a very important subject, and that is the ability of flight attendants to communicate clearly, effectively, and quickly in time of emergency, as you spelled it out—particularly with the cockpit and with the passengers.

Are there any requirements of the FAA for flight attendants who fly in the continental United States? Are there any language standards to be met?

Ms. LEON. Not that I know of.

Mr. OBERSTAR. There are no safety qualification standards for the flight attendants either, are there?

Ms. LEON. No. Not that they be proficient in English.

Mr. OBERSTAR. All right. Do you think there ought to be some standard language requirements that flight attendants who fly in the U.S. should be able to communicate at least on those subject matters that are of crucial importance in time of an emergency?

Ms. LEON. I certainly do. We at American—in times of a hijacking there are certain phrases that you have to use to communicate to the cockpit, and I think it would be very important that there be no mistake or no mix-up in any emergency, because, as we all know, time is of the essence. With an in-flight fire in the cabin there is just no time for any mistakes to be made or for the cockpit to have to repeat information or ask again for the information from the flight attendant to be repeated.

Mr. OBERSTAR. And FAA has not issued any training requirements or suggested to the carrier to establish language proficiency levels?

Ms. LEON. Not that I know of.

Mr. OBERSTAR. Has the union petitioned the FAA for such?

Ms. LEON. Not at this time. I know American Airlines has their own proficiency testing, but I cannot speak to other airlines such as Continental, or even charter airlines.

Mr. OBERSTAR. Could you describe for us the proficiency testing at American?

Ms. LEON. I am not sure if they are testing the foreign nationals with the same requirements that they are of the APFA members. Ours is quite extensive. If you are a French speaker, you must be able to not only give a passenger announcement, but you must be very proficient in emergency commands in the language.

Ms. COYNER. Mr. Chairman, I might add to that that, as you know, there are certification requirements for other members of the flight crew, and those certification requirements include in them being able to be proficient both in written and spoken English. There are not similar certification requirements for flight attendants now.

The APFA contract calls for certain foreign language qualified speakers, and that spells out the testing standards presently for foreign language use such as French, as Ms. Leon mentioned. But we want to emphasize that we think this is not an issue just for the airline, but it is a national policy issue that Congress should take an interest in and the Federal Aviation Administration should take an interest in, as well.

Mr. OBERSTAR. I have heard the safety announcement, for example, on aircraft delivered by a flight attendant who is not a native English speaker, and even with my linguistically-trained ear I have to listen closely sometimes to be sure of what they are saying. And so I wonder about other people who—and I have seen it happen. They lean over to each other and say, "What did she say? What is going on here?" That certainly does not bode well in time of emergency when people get excited and your inflection changes and the urgency of your voice can color the presentation and the inflection and intonation that you are using.

You may have two levels of concern here—one about safety and adequacy of communication skills; and you may have another concern about the use of foreign national flight attendants undercutting the domestic U.S. work force.

Ms. LEON. Yes. I'd like to point out that we had flight attendant base stations in San Juan, in Miami, in New York, in Chicago, in Dallas/Fort Worth, in Los Angeles, and in San Diego. All of these cities have large communities of not only Latin American speakers, but other foreign-speaking citizens.

Mr. OBERSTAR. And there are large hispanic population bases in all of those communities you addressed coming from many of the countries to be served by the routes that American is going to be flying—the former Eastern routes. You'd think that it would be a good idea for those people to have an opportunity to serve in a flight attendant capacity. They would know—if American's interest or any other carrier's interest is in having flight attendants who know the culture, know the language, know the habits of the people of the country they are serving, they could find them right here at home among American nationals, right?

Ms. LEON. That's correct. And some of our members that have been in Latin America researching hotel accommodations for some of our crews that would lay over and pilot crews have told me that they have talked to some of the foreign national flight attendants, and some are proficient in English and others are not.

Again, as testimony we heard this morning, sometimes for a person whose primary language is not English, in an emergency situation it may be a critical thing to be very clear in what you are saying—especially with the cockpit crew member. Our crew members are English-speaking U.S. citizens. English primarily is their first language. So, again, we are concerned about that communication between a Latin American citizen whose language may not be proficient in English.

Mr. OBERSTAR. Is American's plan to have flight attendants who are foreign nationals serving only those routes that American flies in Central and South America?

Ms. LEON. No. They have indicated to us they will also be flying into Miami and into Dallas/Fort Worth. And there is a possibility they could fly into other gateway cities, but at this time they have said they do wish to use these people into Miami and Dallas/Forth Worth.

Mr. OBERSTAR. We certainly have among the Puerto Rican population, alone, a sufficient number of native Spanish-language speakers who also are fluent in English and familiar with the folkways of the U.S. to be able to handle the job and bridge the two cultures and carry out their safety responsibilities effectively.

Thank you very much. I'll have some further questions. At this time I'll call from the gentleman from Missouri, Mr. Hancock.

Mr. HANCOCK. I understand that you had a previous meeting before you came up here to work with the American Airlines on negotiations on the situation with the flight attendants in this particular case. They are saying that they do plan that all flight attendants be fully fluent and proficient in English, but the indication in your testimony here was that there seems to be some question in your mind as to whether that would be accomplished.

Ms. LEON. At this time some of the foreign nationals are being trained at our training center in the Dallas/Fort Worth area, and we also have APFA flight attendants that go through recurrent emergency training. I have received information that they have observed some of the foreign national flight attendants going through the emergency training where you have to give commands, and that some had to do the drills four or five times because their language was not proficient.

I'd like to add that for an APFA member you get only three tries at the drill and you are removed from flying status. So there is some question as to how proficient these people are and if those standards have not been relaxed for those people.

Mr. HANCOCK. I understand you are in negotiation with them now on this thing.

Ms. LEON. Yes. We are meeting next week.

Mr. HANCOCK. And also additional AFPA member jobs have been indicated for these South American operations; is that correct? Some additional positions.

Ms. LEON. They have indicated that.

Mr. HANCOCK. Right. Okay.

I have no further questions. Thank you.

Mr. OBERSTAR. Thank you.

The gentleman from Texas, Mr. Laughlin.

Mr. LAUGHLIN. Thank you, Mr. Chairman.

Ms. Leon, I am one of those that is very impressed with the safety duties and responsibilities of the flight attendants. I sat through a number of the hearings where the flight attendants testified about observations of other flight attendants in times of emergencies. As I recall, Mr. Chairman, one of the flight attendants from the United situation at Sioux City testified. There is no question that you serve a very vital role.

I can tell you of one episode that I experienced flying Turkish Airlines when I was in the Army in Turkey and may have been the only English-speaking person on the plane. We got in very turbulent weather. I thought the pilot had landed and took off again without landing, and I was horrified and I wished we had crashed there over the runway, because we went back in all this turbulent weather and he was talking in Turkish. I knew how to count and ask directions in Turkish and how to bargain, but I didn't understand a word he said. It was the most horrible flying experience I have ever had, and any time it bumps a little bit, regardless of the air carrier, I think about that episode and how frightened I was at that time.

It occurs to me that there is validity to the concern you are expressing, but I wonder if you would be complaining if the flight attendants passed language proficiency tests.

Ms. LEON. The foreign nationals?

Mr. LAUGHLIN. Yes, ma'am.

Ms. LEON. Well, our position is, again, that there is a large community of Latin speakers right in our own Dallas/Fort Worth area, Miami, San Juan. There are pools of U.S. citizens that American could be hiring. Of course, our contractual position is that the flying belongs to us.

Mr. LAUGHLIN. Well, I have a higher percentage of Spanish-speaking people in my district than you have in Dallas, and I appreciate the bilingual capabilities of many of my constituents who slide back and forth from Spanish to English and never lose a nuance, never lose any of their communication skills. I am concerned that you don't think these foreign nationals can be proficient in both English and Spanish. Are you saying that? That's what you seem to be saying to me.

Ms. LEON. Well, the information that has been given to me at this time by members who have been in Latin America is that they have seen some of the people that were interviewed, and some were very proficient, others were very spotty.

Mr. LAUGHLIN. Let me address the ones that are very proficient. Those who are very proficient in English you have no trouble with them from a safety viewpoint; is that correct?

Ms. LEON. As long as they were able to perform, be proficient, and not lapse back in a stressful condition into their mother tongue.

Mr. LAUGHLIN. Also, the observation and concern I have is that American Airlines does not have a policy where they require all their passengers to be English-speaking; isn't that correct?

Ms. LEON. That's correct. Yes.

Mr. LAUGHLIN. And I revert to my Turkish experience. Turkish Airlines certainly took my fare. It was a domestic flight. I have been on their international flights and they certainly have English-speaking people on those. But part of the flight attendant's responsibility, I take it, would be if you have a sizeable percentage of people speaking a different language than English, American would make an effort to have flight attendants with that language capability on that flight for safety reasons, wouldn't they?

Ms. LEON. In fact, with our contract with American we realize their needs and we do have foreign-speaking flight attendants on flights that touch foreign destinations.

Mr. LAUGHLIN. And flights originating in South America and Central America—it would be my impression that a predominant number of those people would be Spanish-speaking people. Would that be your observation?

Ms. LEON. That's true. And on our Tokyo flight we have a large group—most of the travelers are Japanese-speaking, and we have Japanese speakers on those flights.

Mr. LAUGHLIN. I'm aware. I had a very nice flight to Tokyo on American, and your observation is correct. And it serves a good safety purpose because there were a lot of Japanese citizens on that flight.

It really boils down, doesn't it, Ms. Leon, that we need flight attendants who are proficient in English, but if it has got an origination or a destination that is predominantly a different language, it is necessary that at least some of the flight attendants be able to communicate in that language also?

Ms. LEON. Yes. And, again, we realize American Airlines' needs, and we have a contract that does provide for foreign-speaking flight attendants.

Mr. LAUGHLIN. So I guess the bottom line is that you are here stressing and wanting to ensure that American establishes proficiency in English so that the flight attendants can communicate with the crew that is operating the plane?

Ms. LEON. That is of utmost importance. And, again, I'd like to point out not only American—I cannot speak for other requirements at Continental, Eastern, TWA, or charters. I have no idea what kind of proficiency requirements they would have.

Mr. LAUGHLIN. And I suppose the last thing I should ask: are you advocating that U.S. carriers employ only flight attendants who have American citizenship?

Ms. LEON. We have flight attendants that are not U.S. citizens—green card holders. No. What we are saying is that we think the

FAA should look into this and see if there is a problem with foreign nationals and proficiency with English.

Mr. **Laughlin**. Well, I certainly agree with you that they should be proficient.

Thank you very much.

Ms. **Leon**. You are welcome.

Mr. **Oberstar**. Are you suggesting that American Airlines should not be the first carrier to hire non-Americans? [Laughter.]

Mr. Mineta.

Mr. **Mineta**. Mr. Chairman, I apologize for having just come in. I have been reviewing the statement. I really have no questions of Ms. Leon other than to thank her for being before us. Thank you so much.

Mr. **Oberstar**. What is the status of the negotiations between American and AFPA on those South American routes?

Ms. **Leon**. We have met twice, and we will be meeting again next week. We haven't firmed up a time, but we will be meeting next week.

Mr. **Oberstar**. Are you familiar with American's training program for foreign nationals that they hire?

Ms. **Leon**. They have indicated that it is similar to our training program, but——

Mr. **Oberstar**. Do they have a special place where they do that training?

Ms. **Leon**. Yes. It is in the Dallas/Fort Worth area.

Mr. **Oberstar**. And have you seen their syllabus for training?

Ms. **Leon**. No, I have not. In fact——

Mr. **Oberstar**. Have you asked for it?

Ms. **Leon**. We have asked quite a few questions about the foreign nationals. In fact, it is my understanding from other flight attendants who are going through training at this time at the learning center in the Dallas/Fort Worth area that they are isolating the foreign nationals from the AFPA flight attendant members.

Mr. **Oberstar**. American alleges that flight attendants who are South American nationals flying on their routes, if hired, would be allowed to fly into only two gateways—Miami and DFW; is that correct?

Ms. **Leon**. They have indicated that at this time. They have also told us that at this time they will not use them on our routes to Europe, Japan, and Canada, but they reserve that right.

Mr. **Oberstar**. Will they have a different pay scale from AFPA?

Ms. **Leon**. Certainly. Yes. In fact, I have heard from one foreign national through another flight attendant that their pay scale is $300 a month.

Mr. **Oberstar**. Did you say $300 a month? Not $300 a month less, but $300 a month?

Ms. **Leon**. Correct, $300. I believe it is Argentina—the Argentina flight attendants.

Mr. **Oberstar**. Are they going to eat tortillas, or what?

Ms. **Leon**. I don't know what they are going to eat in Miami.

Mr. **Oberstar**. Well, it certainly—they also claim that there is not going to be a loss of AFPA jobs and that there have been new hires since acquiring these routes. What is your response to that?

Ms. LEON. Well, there have been new hires that are AFPA members, but prior to this time APFA members did all of the international flying—all the flying for American Airlines. So now to tell us that we are going to limit you, we do see this as a loss of jobs.

Mr. OBERSTAR. I don't want to be the negotiator or the arbitrator for the negotiations, but what has been American's response to AFPA's proposal to hire American nationals who are of hispanic language origin?

Ms. LEON. They are still maintaining their right to hire foreign nationals. I assume they will still hire some U.S. citizens that are Latin American speaking, but they are maintaining their right to use extensively foreign nationals.

Mr. OBERSTAR. How many flight attendants do you think they are going to need for that purpose?

Ms. LEON. Depending on what kind of an agreement we can come to, if they would use foreign nationals extensively—very few AFPA members, I would say 400 to 500 Latin Americans.

Mr. OBERSTAR. Would they advertise for those positions or recruit for those positions exclusively in those countries in which they will be flying? What are they? Argentina, Venezuela——

Ms. LEON. Colombia.

Mr. OBERSTAR. Colombia.

Ms. LEON. Peru.

Mr. OBERSTAR. Peru.

Ms. LEON. Chile, Central American countries.

Mr. OBERSTAR. Would they advertise only——

Ms. LEON. They are doing that at this time.

Mr. OBERSTAR. Only in those countries?

Ms. LEON. Yes.

Mr. OBERSTAR. Supposing Puerto Ricans applied for those same positions?

Ms. LEON. Well, they are not advertising in San Juan. I assume if they hired a Puerto Rican, they would live, if the Argentine Government would allow it, in Argentina and be paid $300 a month.

Mr. OBERSTAR. Well, I think I have a pretty good feel for this aspect of the issue, but I certainly concur on your viewpoint there are large numbers among the hispanic community who would be thrilled to have the opportunity who would be fully adequate culturally, linguistically, and adaptable to the training and be able to perform the work satisfactorily, and you'd have the best of both worlds—an American citizen who is familiar with U.S. folkways, customs, language, and is also bilingual and can bridge the cultural gap and would serve the purpose for them.

But the safety consideration is something that FAA has to consider under those circumstances, and we'll see to it that they are made aware.

Ms. LEON. Thank you.

Mr. OBERSTAR. We thank you very much for your presentation and for a very splendid presentation, indeed.

[Ms. Leon's prepared statement appears on p. 208.]

Mr. OBERSTAR. We thank all the witnesses for a very illuminating discussion of a subject that has much more complexity to it, now that we have taken a careful look, than it appeared to have at the outset, even given the consideration that I have given over several years to it. I think it is a subject to which we shall necessarily return.

The subcommittee stands adjourned.

[Whereupon, at 4:19 p.m., the subcommittee was recessed, to reconvene at the call of the Chair.]

PREPARED STATEMENTS OF WITNESSES

Statement of J. Roger Fleming,
Senior Vice President, Technical Development and Planning
Air Transport Association of America
Before the House Committee on Public Works and Transportation
Subcommittee on Aviation
on Pilot/Controller Communications Issues
May 24, 1990

Good morning, Mr. Chairman. My name is J. Roger Fleming. I am Senior Vice President, Technical Development and Planning, Air Transport Association of America. I am accompanied today by Mr. Richard Hillman, Vice President Flight Operations, Systems and Standards, Continental Airlines and Mr. Joseph F. McLaughlin, Vice President, Flying, USAir.

ATA and its member airlines recognize that accurate, concise and effective pilot/controller communications are essential to safe and efficient operation within the National Airspace System. Each day the airlines and package/freight carriers operate approximately 18,000 flights -- about 6.3 million scheduled flights per year -- between domestic points. In addition, U.S. carriers operate about 328,000 scheduled flights per year in international services. FAA regulations require that virtually all of these air carrier flights operate in accordance with the Instrument Flight Rules. This means that all flights interact with the air traffic control service and all must have an air traffic control clearance to operate. Thus, it is apparent that the airlines and their flight crew members have a vital interest in safe, effective pilot/controller communications.

Pilot/controller communications procedures and discipline are an integral part of the flight training curriculum from the time a student pilot begins his or her initial flight training. A pilot with a private or commercial license must learn and demonstrate knowledge of all fundamental ATC procedures, including communications practices, as a prerequisite for issuance of an instrument rating. Entry level airline copilot qualifications include, as a minimum, a commercial license and an instrument rating. Therefore, all airline pilots have acquired the necessary communications qualifications for operation under the Instrument Flight Rules (IFR) by the time they start their flying career with an airline.

Subsequent training in communications practices deals primarily with reinforcing the need for proper communications discipline, the need to adhere to standard phraseology, and avoiding the mistakes others have already made. Errors in communications between pilots and controllers are not a new development -- nor are errors involving communications between pilots within the same cockpit new or unique. Continuous effort is required to insure that all pilots and controllers understand the need for vigilance and discipline in order to reduce the chance that a communications error might result in or contribute to an accident.

Airlines pursue their own initiatives as well as participating with government and industry groups in seeking to improve pilot/controller communications and eliminating or reducing the sources of communications errors. The most recent joint government/industry effort in pursuit of these objectives is a Communications Awareness Initiative -- a "Call to Action." This initiative was launched by the FAA's Air Traffic Procedures Advisory Committee (ATPAC) in response to growing concern about effective communications between pilots and air traffic controllers. The ATPAC, which includes ATA and representatives from 14 other airspace user organizations, urged that FAA and industry, working together, develop a plan to improve pilot and controller awareness of the need for vigilance and discipline to reduce the potential for error.

The "Call to Action" communications program focused attention on the following areas of concern:

- Similar sounding alphanumerics, e.g., aircraft callsigns
- Controller hearback problems
- Readback problems
- Phraseology
- Enunciation
- Radio discipline
- Intra-cockpit communications
- Blocked or simultaneous transmissions
- Stuck microphones
- Use of headsets versus speakers
- Initial radio contact
- Controller coordination communication

In addition to our participation in the Communication Awareness program "Call to Action," ATA is working now and will continue to work with FAA on their "Readback/Feedback" program. This program, which evolved from the Communications Awareness activity, identifies both incidence of communication errors and types of errors. That activity represents the "readback" in the program name. The program also seeks to contribute to correction of these errors by providing information on the incident to the individual involved and to related organizations such as the individual's employer. This is the "feedback" function. We, as well as FAA, recognize that this is a labor intensive process. However, it is individuals who make the errors and it is individuals who must be made aware of the error and its consequences, if corrective action is expected.

ATA and its member carriers also support another important activity -- the FAA/NASA Aviation Safety Reporting System (ASRS) -- which has done an outstanding job in documenting what they characterize as the "Hearback" problem. Two ASRS special study reports have been published on this problem. These study reports identify areas that require continued reinforcement in training and operational discipline on the part of operating aircrew and air traffic controllers, who share responsibility to communicate clearly with each other and to do all that is possible to remove the potential for misunderstanding.

Readback, hearback and other communications problems are covered in airline flight crewmember training programs in a number of ways: communications practices are treated in ground training sessions in connection with new hire training; they are reviewed in periodic bulletins that are circulated to crewmembers; they are highlighted in flight safety publications that are circulated within the individual airline; and they are incorporated in Cockpit Resource Management (CRM) programs. Communications functions are also an integral part of Line Oriented Flight Training (LOFT) scenarios conducted in the simulator. Publications such as the NASA ASRS monthly bulletin titled "Callback" are valuable and widely read throughout the community.

There are numerous training options available to airlines to focus attention on communications issues. Ingenuity and diversity must be utilized to reinforce the safety message and to avoid boredom with a set of issues that are commonplace to everyday human activity. The need for effective communication extends to nearly every activity we pursue in our daily lives.

To those of us concerned with issues related to effective communications, technical solutions, such as an expanded use of data link, offer promise. One data link system in common use by airlines is known as ACARS, or Aircraft Communication Addressing and Reporting System. Two airlines are already using this system to replace some of the voice communications between the airplane and an ATC facility. These airlines are utilizing ACARS to receive their flight clearances while they are on the ground. This feature reduces demand on the clearance delivery frequency making it more accessible for non-ACARS equipped aircraft. it also ensures accuracy in transmitting and receiving as the clearance is not read by one person and copied by another. ACARS is also utilized by some carriers for receipt of oceanic track clearances.

Other data link applications which present information either as printed copy, utilizing a miniature printer, or displayed on a screen in the cockpit are potentially attractive. However, the method has limitations. Introducing a communications technique which necessitates a crewmember focusing his or her attention away from outside visual traffic scan or other essential duties may not be optimal.

Data link applications do offer promise in reducing some of the most common hearback errors, such as clearances accepted by the wrong crew or altitude assignments that were misunderstood. Such clearances would be confirmed by display or print copies. However, any decision to embrace either printed, hard copy or video display information as a means to communicate with aircrew while airborne in terminal environments must be approached very carefully and not considered as an obvious solution to communications errors.

In a sense, data link has both significant potential to improve communication and disadvantages which must be accommodated or overcome. The Air Transport Association has formed an Information Transfer/Data Link Human Factors Working Group to develop recommendations in this area. The group includes air carrier operators, air traffic controllers and pilot organizations as well as NASA and FAA Research and Development representatives. This work falls within the scope of the National Plan to Enhance Aviation Safety Through Human Factors Improvements -- a plan developed by the same group of government and industry participants and now being used as a basis for the FAA's human factors research program. ATA and its member airlines will continue to support data link and human factors studies as potential contributors to the reduction of communications errors.

Mr. Chairman, your hearing announcement asked for views on problems resulting from use of English as a second language. As you know, English is one of the international languages sanctioned by the International Civil Aviation Organization (ICAO) for communications between ground stations and airplanes and it is the most widely used language. The problems associated with use of English as a second language within the U. S. are not unique. We must recognize that U.S. citizens from different parts of the country sometimes have difficulty understanding each other. Such difficulties demand discipline from system participants to insure that important messages are standard with respect to form, content and phraseology.

ATA supports efforts within ICAO to achieve and utilize standard phraseology as a critical element in overcoming some of the communications difficulties associated with pilot controller communications where the parties do not share the same native language. It should be noted that U. S. pilots experience similar difficulties operating in some areas outside the United States, where the air traffic controllers use another language to control local traffic and use English to control international traffic.

Summary

Safe and effective communications requires discipline and a conscious effort on the part of all controllers and pilots participating in the air traffic control system. FAA and user organization efforts such as "Call to Action" and "Readback/Feedback" deserve full support. Human factors research directed at identifying sources of common communications errors must be pursued vigorously and needed changes in operating procedures or practices introduced where justified by research results. Finally, technological developments, such as more widespread use of data link, should also be fully investigated as possible means to reduce communications errors.

This completes our statement, Mr. Chairman. We would be pleased to answer any questions you may have.

STATEMENT

OF

Dr. R. Curtis Graeber
Head, Aeronautics Human Factors Branch,
Aerospace Human Factors Research Division
Ames Research Center
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

before the

Subcommittee on Aviation
Committee on Public Works and Transportation
House of Representatives

Mr. Chairman and Members of the Committee:

I welcome this opportunity to appear before you to discuss NASA's aviation safety research activities which address the issue of pilot/air traffic controller communications.

I am responsible for the aeronautical human factors research program at NASA Ames Research Center which includes the subject of cockpit/air traffic control (ATC) communications, as well as the management of the Aviation Safety Reporting System (ASRS). I will briefly discuss relevant research and analyses carried out within NASA's Aeronautics Research and Technology Program directed at understanding and reducing human errors within aviation operations. These research activities can be broadly divided into two categories: (1) those which deal with understanding and eliminating avoidable safety problems within the current National Airspace System (NAS), and (2) those which attempt to develop new technological solutions to existing and foreseen problems. These activities are conducted in close cooperation with the Federal Aviation Administration (FAA).

Aviation Safety Reporting System: Understanding the Problem

The Aviation Safety Reporting System (ASRS) has been a major contributor to the understanding of pilot/air traffic controller communication problems. The ASRS, established in 1976, is operated by NASA for the FAA to assist in the identification of unsafe conditions and prevention of avoidable accidents. It does so by means of a confidential, third-party reporting system whereby pilots, air traffic controllers, and others report actual or potential discrepancies and deficiencies involving the safety of aircraft operations without fear of punitive consequences. In the initial five years, 1976-1981, 70% of the 28,000 reports noted problems in the transfer of information within the aviation system. Since 1976, approximately 140,000 ASRS reports have been filed and information transfer problems continue to represent the largest category of reports. Output from the ASRS has two basic functions: to notify the aviation community of the existence of alleged hazards in the system and to attempt to explain why certain conditions or situations exist. The first function is accomplished through Alert Bulletins and through Callback, a monthly safety publication. The second function is accomplished through technical papers describing the results and conclusions drawn from analyzing ASRS reports. These papers are made available publicly through normal NASA publication channels. Also, we conduct database searches of the ASRS in response to requests by the FAA, the National Transportation Safety Board, Congressional offices, and other interested parties in the public and private sectors. Reports generated from ASRS data provide a broad database for NASA aviation safety research.

Certain caveats apply to the use and interpretation of ASRS data. All ASRS reports are voluntarily submitted and thus cannot be considered a random sample of the full population of like events. Further, not all pilots, controllers or other participants in the aviation system are equally aware of ASRS or are equally willing to report an incident. Thus, the data may reflect a reporting bias. Nevertheless, we believe that the ASRS data represent a conservative measure of the true number of incident reports.

Recent and preliminary ASRS data on communications problems are provided in the attached tables. These tables summarize the number and percentages of reported incidents in two selected categories for 1988 and 1989. Table 1 summarizes reports of communication problems in which controller actions led to violation of aircraft separation standards. Table 2 summarizes reports of communication problems which involved pilot infractions of FAA regulations. An Appendix to this testimony provides a description and example of each of the communication problem areas.

NASA Aviation Human Factors Program: New Technological Solutions

Starting in 1989, NASA increased the human factors research directed at aviation safety and automation with the primary objective of improving the safety of the National Airspace System through development and integration of automation technologies for aircraft crews and air traffic controllers. This applied activity addresses three important and interlocking research areas: (1) understanding and providing guidelines for effective and safe interfaces between humans and automation; (2) developing the technology for intelligent, error-tolerant cockpits and ATC systems; and (3) providing effective cockpit/ATC integration. Information management is an essential part of this research and is focused on improving pilot-controller communications.

Increased cockpit automation is occurring due to the introduction of more flexible electronic displays and a variety of automated flight system management devices. These new systems provide the flight crew with a capability to fly optimum flight paths, to achieve maximum fuel economy and to achieve precise airport arrival times. However, the air traffic management system does not permit full use of these capabilities. Less than 20% of all automated flights are completed as planned, due to revisions in ATC instructions, especially during descent and in terminal areas. The result is reduced fuel economy, increased workload and, under some conditions, reduced attention to critical monitoring and management tasks.

NASA has pioneered the development of crew resource management (CRM) and line oriented flight training (LOFT) for airline crews. This research area deals with the way cockpit crews communicate with each other and with controllers. This research is conducted with the cooperation of the commercial airlines, the FAA, and others. Its impact lies in the training of crews to fully utilize all resources available to them in dealing with unplanned incidents and contingencies. Communications, as a resource, is emphasized. CRM training has been adopted by numerous U.S. and international air carriers. During the past year, CRM training has been cited as a major factor in the heroic efforts aboard United Flight 232 at Sioux City when the aircraft suffered an uncontained failure of the #2 engine and in United Flight 811 out of Honolulu that lost a cargo door.

NASA is conducting a fundamental research effort on routine air-ground communications. The program includes a field test to evaluate different words and phrases used in the communication of information to determine the actual information content provided by these words and phrases. This study will provide a data base and recommendations to enhance CRM training programs.

At NASA's Ames Research Center, investigators are determining better methods and techniques to provide pictorial displays of enroute weather to the crew. A prototype of an automated weather data information management system, including a display of weather in the terminal area, has been developed and evaluated in simulation. Fixed-base simulations of new display formats are being conducted in the Man-Vehicle Systems Research Facility and results are expected to be available in September 1990.

Our research program to develop new technological solutions to communications problems within aviation operations is primarily based on the use of digital datalink. An effort at the NASA Langley Research Center is focused on exchanges of digital messages between aircraft and ATC. The emphasis of this research is on airborne operational requirements. Numerous fixed-base piloted simulations have been completed using airline flight crews, NASA test pilots, and Air Force transport pilots. A flight validation study of datalink technology using the NASA Transport Systems Research Vehicle is under way. The objective of the flight tests are to compare current voice communications with digital information transfer during full mission flight scenarios typical of commercial airline flight operations. The flight tests are intended to validate results of previous fixed-based simulations and explore modified display formats and procedures. Specific areas of emphasis include: (1) crew's acceptance and perceived workload, (2) round-trip communications response time, (3) operations with an advanced datalink/crew interface, and (4) the practicality of single action pilot entry of messages into aircraft subsystems. Initial data tends to validate the earlier fixed-based simulation results. Subject pilots reported very favorably on the features embedded in this advanced interface concept. Final data analysis will be completed by the fall of 1990.

The results of our datalink research to date can be summarized as follows:

1. Overall flight deck workload can be reduced, with automated entry of data into flight management systems.
2. Significant reductions in datalink communications errors were measured as compared to conventional voice radio communications.
3. Strategic, routine and tactical weather information are all good candidates for information transfer.
4. Both current Control Display Units and dedicated displays are viable interfaces.
5. Synthetic speech of messages, touch panel displays, and yoke-mounted reply switches are all useful.
6. A mechanistic or equipment-centered approach to communications problems is not a solution. Appropriate use of human capabilities and proper use of technology by crews and controller are necessary.

We have also initiated a study with the Douglas Aircraft Company to assess the viability of retrofit concepts to permit current commercial transport aircraft to operate in the NAS with the evolving aircraft/datalink systems. This will include an analysis of the integration of controls, displays, and operating procedures to support the datalink function. This study will be completed in May 1991.

To further enhance the safety and capacity of the National Airspace System, we have strengthened our cooperation with the FAA. An agreement between the FAA and NASA was signed by the respective Administrators in January 1990 which formally reconstituted the FAA-NASA Coordinating Committee and outlined a top-level framework for cooperation. This framework is composed of six major areas of focus: Human Factors, Severe Weather, Environmental Compatibility, Cockpit/Air Traffic Control Integration, Airworthiness and Program Support.

The FAA, with the cooperation of NASA, is developing a national plan for aviation human factors research in response to the Aviation Safety Research Act of 1988. The national plan builds on NASA's fundamental and applied human factors research activities.

In conclusion, the ASRS database provides evidence of numerous communication problems within aviation operations. We have strengthened our relationships with the FAA and will cooperatively address these problems through our fundamental and applied human factors research activities. Finally, I believe that a continued emphasis on understanding aviation communication problems and continuation of fundamental and focused research are the paths to successfully dealing with cockpit-controller communications.

Thank you Mr. Chairman. That completes my prepared testimony. I would be happy to answer questions.

APPENDIX A- Definition of Communications Problem Areas

1. Similar sounding alphanumerics: This problem area refers to the confusion resulting from similar sounding call signs or duplicative control instructions issued to similar aircraft types. The most prevalent example of this circumstance involves similar call signs. For example, two aircraft, one a Cessna N1523Q and the other a Beech N28223Q, are in an approach-fix holding pattern. The controller shortens the aircraft call signs to "23Q," and neither pilot catches the error. Both aircraft accept the clearance and acknowledge "23Q, roger." The controller does not catch the error, resulting in a "hearback" problem.

2. Readback/Hearback problems: This problem area refers to instances when the pilot or controller has difficulty repeating, hearing and fully understanding what the other party says when reading back a clearance, issuing instructions, or providing information. ASRS sees a steady flow of reports that reference problems with clearance verification. The incident types most often associated with these errors f are those involving ATC instructions. For example, a controller asks for a pilot to report leaving 6,000 feet during descent. (The controller probably has conflicting traffic at 5,000 feet.) The pilot later reports leaving 9,000 feet, but the controller hears 6,000 feet because that is what he wants to hear and expects to hear.

3. Phraseology: This problem area refers to the improper use of established and recommended phraseology by pilots and controllers. Altitude deviations, airborne conflicts, and runway incursions are the most frequently seen occurrences related to phraseology problems. For example, not using the standard terminology prescribed in the Pilot/Controller Glossary, an FAA standard reference document, such as "OK".

4. Headsets versus speakers: This problem area refers to the effectiveness of communications using either method. Occasionally reporters (usually pilots) refer to difficulty in understanding radio calls when they are not using headsets. For example--ASRS reports for the period 1982 to 1988 identified 29,647 communications incidents. A large number of these reports cited the use of speakers as a factor in the incident. One pilot said, "The receiver (speaker) was turned all the way down and the controller had been trying to contact us for 20 miles."

5. Pilot Communication Technique: This problem refers to a wide variety of communications problems fostered by pilots who fail to phrase their message correctly, by the improper or poor techniques in communicating by radio, or failure to originate an important message to ATC. This results in confusion among the people communicating and a frustration of the ATC system. For example, a pilot flying in visual flight rules calls for a weather watch update on frequency 122.0, "Flight watch, Cessna one two three Kilo, on 122.0, Over." This message was incomplete because the "address" or location of the aircraft relative to the nearest ATC station was not provided in the transmission.

6. Interfacility Coordination: ASRS reports often allude to some breakdown in interfacility coordination. As such, the types of incidents where this problem would be manifested are those involving ATC clearances or traffic advisories. For example, an erroneous airspace entry is made by one facility when an aircraft is handed off from a second facility.

7. Intrafacility Coordination: This problem refers to airborne conflict incidents. Often this occurs when an aircraft is handed from one sector to another. Coordination problems in air traffic control towers are also included and usually appear when there is some breakdown between the ground and local control positions. For example, a controller is giving a lengthy clearance to a pilot while at the same time a second controller physically points to an aircraft on the first controller's radar scope. The first controller shakes his head "yes" or gives a thumbs up. He may have been shaking his head because of what the pilot said, not what the second controller did.

8. Frequency Congestion: This problem refers to the technical capability to initiate a transmission on the same, occupied radio frequency. The result is too many messages which interfere with each other, resulting in the loss of information. This problem is inherent when a partyline system is used, such that one radio frequency is used by a number of pilots with a controller station. One aspect of the problem is frequency blockage. For example, one party in a communications net talking while another party is speaking.

9. Stuck microphones: This is a relatively rare occurrence , but when it does occur it can cause confusing and potentially dangerous situations. This problem refers to the unintentional continuous keying of the microphone which results in frequency blockage. For example, a near midair collision occurred between two air carriers in which a stuck microphone kept air crews from hearing separation instructions from ATC. An investigation shows that one carrier had a mike continuously keyed for over five minutes.

10.Controller Communication Technique: This problem refers to when a controller may have used less-than-optimum means for communicating his message. It may be a phraseology problem or an issue about what information was communicated by the controller and when. For example, in providing a clearance for changing altitude, the words or phrases used may cause the pilot to actually commit an altitude deviation.

11. Language Problems: Difficulties due to accents used by the speaker, or lack of understanding of the English language are reported. When they occur, language problems are not associated with any particular type event. For example, errors in voice volume, rate of speech, voice inflection, and similar sounds. Pronunciation and accentuation of certain words are dependent on the native language of the speaker, even when speaking grammatically correct English.

	1988		1989	
Communication Problem Area**	Citations	Percent	Citations	Percent
Controller Communication Technique	262	31 %	601	45 %
Frequency Congestion	47	6 %	60	5 %
Headset/Speaker Problems	6	1 %	12	1 %
Interfacility Coordination	133	16 %	295	22 %
Intrafacility Coordination	102	12 %	192	15 %
Language Problems	4	0 %	7	1 %
Phraseology	46	5 %	37	3 %
Pilot Commmunication Technique	184	22 %	367	28 %
Readback/Hearback	100	12 %	257	19 %
Similar Sounding Alphanumerics	55	7 %	66	5 %
Simultaneous Transmission	12	1 %	10	1 %
Total Operational Errors/Deviations	839	100 %	1,324	100 %
Total Database Incidents	16,320		24,915	

** Communications problem areas are not mutually exclusive groups

Table 1. - Operation Errors and Deviations

	1988		1989	
Communication Problem Area**	Citations	Percent	Citations	Percent
Controller Commmunication Technique	141	8 %	355	11 %
Frequency Congestion	67	4 %	87	3 %
Headset/Speaker Problems	33	2 %	34	1 %
Interfacility Coordination	24	1 %	52	2 %
Intrafacility Coordination	10	1 %	21	1 %
Language Problems	16	1 %	32	1 %
Phraseology	80	4 %	80	2 %
Pilot Commmunication Technique	153	8 %	330	10 %
Readback/Hearback	130	7 %	248	8 %
Similar Sounding Alphanumerics	46	3 %	66	2 %
Simultaneous Transmission	9	0 %	8	0 %
Discrete Information Transfer Failure	477	26 %	1,040	32 %
Total Operational Errors/Devs	1,837	100 %	3,272	100 %
Total Database Incidents	16,320	▨	24,915	▨

** Communications problem areas are not mutually exclusive groups

Table 2. - Pilot Deviations

STATEMENT OF DAVID R. KELLEY, CHIEF,
OPERATIONAL FACTORS DIVISION, NATIONAL
TRANSPORTATION SAFETY BOARD

Mr. Chairman, Members of the Committee, I want to thank you for this opportunity to present the views of the National Transportation Safety Board concerning the problems associated with pilot and air traffic controller communications. You are to be commended for your concern about this problem and its effect on the safety of the traveling public throughout the nation.

We at the Safety Board share your concerns. The Safety Board believes that deficiencies in communication, which often result in runway incursions and near midair collisions with their attendant potential for an actual collision, represent one of the most serious problems affecting commercial aviation operations today.

The 1977 ground collision of two Boeing B-747 airplanes at Tenerife Airport in the Canary Islands remains a grim reminder of the consequences of incomplete or misunderstood communications between pilots and controllers. There were five hundred and eighty-three fatalities as a result of that collision -- the largest number of lives lost in any aviation accident in history. More recently, on January 25, 1990, Avianca Airlines flight 052, a Boeing 707-321B, crashed near Cove Neck, New York resulting in 73 fatalities and 82 serious injuries to the occupants. The Safety Board believes that incomplete communication between the flightcrew and controllers may have contributed, at least in part, to that accident.

The Safety Board has investigated numerous accidents and incidents involving pilot/controller communication problems. On December 1, 1974, Trans World Airlines flight 514 crashed 25 miles northwest of the Dulles International Airport. The accident occurred while the flight was descending for an approach during instrument meteorological conditions. All occupants -- 85 passengers and 7 crewmembers -- received fatal injuries. The Safety Board determined that the probable cause of the accident was the crew's decision to descend to 1,800 feet before the aircraft had reached the approach segment where that minimum altitude applied. The crew's decision to descend was a result of inadequacies in the air traffic control procedures, which led to a misunderstanding on the part of the pilots and controllers.

On March 1, 1985, two Northwest Airlines DC-10 airplanes nearly collided at the Minneapolis-St. Paul International Airport. One airplane was taking off from a runway while the other airplane was taxiing across the same runway. A collision was barely averted when the captain of the takeoff airplane rotated his airplane prematurely and overflew the taxiing airplane by an estimated distance of 75 feet. There were 501 persons aboard the two DC-10s and there were numerous other airplanes taxiing nearby. The Safety Board determined that the runway incursion occurred because of incomplete and/or misunderstood verbal coordination between the local and ground controllers in the tower.

On March 1, 1989, a near midair collision occurred seven miles west of the Houston International Airport at 3,200 feet. Trans World Airlines flight 806, an MD-80, and Continental Airlines flight 122, also an MD-80, were receiving ATC services from the final north radar controller at the Houston TRACON. The controller cleared the Continental pilot to "... turn left to three sixty." The controllers' use of the words "three sixty" is not in accordance with the controllers' handbook and was understood by the

Continental crew to mean "make a three sixty." The near collision resulted when Continental, instead of turning left to a heading of three six zero, made a three hundred and sixty degree turn to the right and passed the TWA flight at the same altitude and with .079 miles lateral separation while in instrument meteorological conditions.

On December 15, 1989, an FAA flight check Beech King Air BE-300 passed in front of a Trans World Airlines B-727 at 24,000 feet approximately 30 miles north of Ormond Beach, Florida with zero feet vertical and .8 mile lateral separation. The B-727 had to climb as evasive action to avoid the BE-300. The radar controller was aware of the pending conflict and attempted to vector the airplanes apart, however the flightcrew of the BE-300 inadvertently responded to the clearances that were issued to the B-727. This occurred twice and contributed to the close proximity of the two airplanes. The controller informed Safety Board investigators that the flightcrew of the BE-300 did not react to his clearances the way he expected.

Finally, the Safety Board is currently investigating an accident which occurred on January 18, 1990, at the Atlanta Hartsfield International Airport. The accident occurred when an Eastern Airlines Boeing 727 collided with a Beechcraft King Air after landing on runway 26R. The flightcrews of both airplanes had been issued landing clearances by the north local controller in the tower cab.

After colliding with the King Air, the Eastern B-727 continued down the runway and was able to clear at a taxiway where the passengers and flightcrew were deplaned. The Boeing 727 suffered substantial damage; however, none of the flightcrew or passengers were injured. The King Air was destroyed by the impact, fatally injuring the pilot and seriously injuring the co-pilot.

Our investigation has determined that the local controller, after issuing landing clearances to both aircraft, became distracted while attempting to communicate with the flightcrew of a Continental Airlines turbojet which had preceded both aircraft for a landing on runway 26R and was taxiing to the terminal area. As a result of this distraction, and the local controller's focused attention, the controller failed to scan the runway to make sure that the King Air was clear of the landing area.

Preliminary evidence gained from the investigation of the Avianca accident indicates that the flightcrew did not properly convey the critical nature of their aircraft's fuel state to three different ATC facilities. Because of the nonstandard phraseology that was used by the flightcrew, the controllers did not perceive the urgency of the flight's fuel state and, as a result, the information was not passed from facility to facility and Avianca was not provided with traffic priority to ensure a safe landing.

Finally, on February 27, 1990, American Airlines flight 158, a DC-10, and American Airlines flight 341, an MD-80, came within 100 feet vertical and one mile horizontal separation at 10,300 feet near the Dallas/Fort Worth Airport. The operational error occurred when the controller issued a clearance to Delta Airlines flight 558, a B-757, to descend to 5,000 feet, however, American 158 acknowledged the clearance and started a descent from

11,000 feet. The controller failed to detect that the wrong flightcrew had responded to the clearance.

While the Safety Board is aware of numerous other occurrences resulting from communication deficiencies, I believe that these incidents exemplify the problem. Our investigations have indicated that the problem affects pilots and controllers alike. One or both lack a complete understanding of the intent of the other and, as a result, fail to adhere to, or comply with, a clearance, an instruction, or other established procedures. In short, there is an incomplete transfer of information. The FAA classifies an occurrence as a pilot deviation when the performance deficiency is attributed to the flightcrew, or as an operational error when a controller's performance is deficient.

The FAA was requested by the Safety Board to provide statistical data concerning the number of pilot deviations and operational errors in which communication(s) was a contributing factor during the past three years. The FAA reported the number of operational errors involving communication problems has decreased during the last three years from 257 during 1987 to 241 and 214 during 1988 and 1989, respectively. The Safety Board was surprised to learn that FAA's database for pilot deviations does not contain the reasons (cause/factor) for a deviation. While each pilot deviation is investigated and the individual report form may contain this information, it is not transferred to the computer data files. The Safety Board's staff was advised by the FAA in 1988 that it was changing its system to record this information. However, to our knowledge this has not yet been implemented.

Communications problems manifest themselves in many forms. Recently, Battelle's Aviation Safety Reporting System Program Office completed a research study concerning communications problems. The study reviewed reports submitted by controllers and listed the leading communication errors as:

- Clearance composition -- including a wrong heading or altitude assignment, inappropriate or misleading instructions, and issuance of clearances to the wrong aircraft.
- Phraseology and delivery techniques -- this category involved the use of non-standard terminology in clearances and poor controller radio techniques such as overly rapid issuance of clearances.
- Read back/hear back--this problem involves controllers who fail to detect and correct erroneous flightcrew read backs.

Factors that contributed to these communication errors were listed as heavy traffic causing controller overload, similar aircraft call signs, congested frequencies, and combined ATC positions or sectors.

The study also reviewed flightcrew performance reports and listed the communication errors as:

- Confusion over altitude assignment;
- Failure to request clarification of confusing instructions; and
- Failure to adhere to a heading assignment.

The leading factors that contributed to these errors were frequency congestion (including blocked transmissions), radio communications and traffic watch.

The study's principal conclusion was that, "...a substantial number of controllers are handling too much traffic, or traffic mixes that are too complex...." To address this finding, the study recommended that the FAA continue to hire and train new controllers and to implement more stringent traffic management procedures. The study also suggests the need for more accountability by the FAA for both pilots and controllers whose communication deficiencies result in deviations or errors. The Safety Board concurs with the findings and recommendations of this study. We believe that the study accurately identifies many of the factors that cause or contribute to communication errors and provides suggestions to address those issues.

The FAA has been very responsive to the urgent safety recommendations issued by the Safety Board on February 21, 1990, concerning the Avianca accident. The FAA issued an action notice requiring distribution of the recommendation letter to appropriate flight standards organizations within the FAA and to each air carrier involved in commercial operations in the U.S. national airspace system. Also, as a result of our safety recommendations, the FAA required that all controllers be briefed on the circumstances of the Avianca accident and on the importance of accurate pilot/controller communications.

However, the FAA did not fully concur with all of the Safety Board's recommendations issued last year that also addressed communication problems. Following our investigation of an operational error at the New York TRACON, we issued eight safety recommendations to the FAA on August 11, 1989. The error occurred when the controller confused similar flight call signs of Trans World Airlines flights 843 and 834, and issued clearances to one flight that were actually intended for the other. Three of our safety recommendations to the FAA addressed the need for corrective actions concerning duplicate and similar flight call signs that are in simultaneous use.

More recently, on December 5, 1989, the Safety Board issued eleven safety recommendations to the FAA as a result of our investigation of a fatal accident near Adams, Massachusetts. The accident occurred when the controller allowed the pilot of a Cessna 172 to maintain an altitude that was below the minimum vectoring altitude in that area and the airplane struck high terrain. One of the ensuing recommendations urged the FAA to issue a General Notice to all controllers reminding them of the need to identify and correct communication errors that pilots make in response to their transmissions. The FAA's response stated that it had taken previous efforts to address this issue and no need existed to issue a General Notice at this time.

One of the efforts mentioned by the FAA was the document, "CALL TO ACTION." This 16-page publication, Pilot/Controller Communication Awareness, was developed in 1988 by a joint FAA/DOD/Industry working group to foster improved communications between pilots and controllers. It provides a description, discussion and potential solution for twelve major areas of pilot/controller communication problems. The Safety Board believes that "CALL TO ACTION" is an excellent document for use in training programs to improve communications between pilots and controllers. The paper was distributed to pilots, controllers, airlines, and other system users during late 1988 and early 1989.

However, the FAA and the Safety Board have found that the distribution of "CALL TO ACTION" was apparently too restricted and as a result its effectiveness was limited. The FAA's report of its recent System Safety and Efficiency Review of the Northeast Corridor stated that most pilots who were interviewed during the review were not aware of this major communication awareness program. Safety Board investigations of incidents involving communication problems also confirm that the training aid did not reach all pilots and controllers.

Information released by the FAA in June 1989, in their System Safety and Efficiency Review concluded that proper communication techniques and phraseology should be reemphasized during the training and checking phases of pilot and controller evaluations. On August 18, 1989, the review issued two internal recommendations concerning the need for improvements in communications. FAA Recommendation NEC016 stated that, within 180 days, the FAA should reactivate "CALL TO ACTION" with greater emphasis placed on the dissemination of the publication. However, the FAA, as of now, has still not acted on its own recommendation. Another FAA recommendation, NEC017, suggested that the FAA's Flight Standards Service initiate a special emphasis item on enroute inspections and check rides of air carrier flightcrews to evaluate pilot communication skills and phraseology. Flight standards personnel reviewed this recommendation and concluded that there was no "... significant flight standards safety or efficiency problem..." and that no further action was required.

The Safety Board believes FAA should reconsider their position on these two recommendations.

The FAA has initiated several efforts that may be helpful in improving communications within the ATC system:

-- FAA's Flight Standards and Air Traffic Services have established a human factors work group to study ways to improve pilot/controller communications. This joint government, industry and military work group met for the first time on March 6, 1990. It intends to analyze previous pilot/controller communication errors, listen to ATC system communications, conduct interviews and surveys of system users and recommend measures to reduce communication read back/hear back problems and other common errors.

-- The Air Traffic Service is studying ways to improve controller training programs to address the communication problem. Initial and refresher training curricula and laboratory scenarios will be expanded to focus on read back/hear back errors.

-- Air Traffic Service has also initiated a total review of the Air Traffic Control Handbook to evaluate and change, if necessary, controller procedures and the relevant phraseology to be used with each procedure.

-- Flight Standards Service has announced a new recurrent training program for pilots and mechanics. This accident prevention program, titled "Back to Basics II," will run for five years from 1990 - 1994 and will focus on improvements in aviation safety by reducing the number of accidents caused by operator or maintenance errors.

-- Safety seminars will address a particular topic for each six-month period and communication is scheduled as the principal area of concern during the first half of calendar year 1992.

Finally, the Safety Board issued Safety Recommendation A-86-33 to the FAA on May 13, 1986. This was one of 14 recommendations which resulted from the Board's special investigation of runway incursions. It recommended the FAA:

Require controllers to obtain a readback for all hold, takeoff, or crossing clearances and for clearances onto an active runway.

The FAA requested comments from system users on this proposal and also tested this requirement in the Southern and New England Regions. The FAA decided, as a result of the negative comments received and its own test program, that this requirement would not enhance safety or ATC procedures. The FAA advised the Safety Board on April 5, 1990 that, as an alternate course of action, it is considering proposed rulemaking to require pilots to acknowledge all ATC clearances with the aircraft call sign. The Safety Board has not completed its evaluation of the FAA response.

Ultimately air to ground voice communications will be augmented with the implementation and use of the Mode Select Beacon System (MODE S). MODE S, with its digital data link, will provide a discrete addressability through use of a surveillance radar on the ground and a transponder in the airplane. This link will facilitate exchange of weather information, initially, and structured ATC clearances and advisories during the second phase of development. Information will be displayed on a CRT or printed as a hard copy report in the airplane cockpit. Positive exchange of information via data link will reduce frequency congestion and pilot/controller workload, and, as a result, will increase communication efficiency and safety.

For example, the FAA and two major U.S. air carriers are currently conducting a research and development program at Chicago O'Hare International Airport in which the communication of ATC pre-departure route/altitude clearances is done via data link. Approximately 700 pre-departure clearances are transmitted daily directly to the cockpit or to the flight's departure gate. The O'Hare Airport clearance delivery controller does not participate, in any manner, in issuing these clearances. The FAA estimates that this program has resulted in a 60 percent reduction in voice communication and controller workload for O'Hare pre-departure clearance deliveries.

The FAA's schedule for implementation of the ATC data link communications starts in late 1995 when two enroute centers become operational. The remaining 18 centers will be equipped during the period 1996-2000. The Safety Board supports these ongoing and future initiatives and believes that they will contribute to better communications between pilots and controllers.

In summary, the Safety Board believes that erroneous communications between pilots and controllers endangers the integrity of the national airspace system. As air traffic and frequency congestion increase, effective management of the ATC system will be achieved only through the use of clear, standard, complete and understood communications between system users and controllers. The Safety Board will continue to monitor this problem and to urge the FAA to continue to focus on this hazard to aviation safety.

Mr. Chairman, that concludes my formal statement. I will be pleased to respond to any questions that you may have.

STATEMENT OF JOHN S. KERN, DEPUTY ASSOCIATE ADMINISTRATOR FOR REGULATION AND CERTIFICATIION, FEDERAL AVIATION ADMINISTRATION, BEFORE THE HOUSE COMMITTEE ON PUBLIC WORKS AND TRANSPORTATION, SUBCOMMITTEE ON AVIATION, CONCERNING PILOT/CONTROLLER COMMUNICATIONS. May 24, 1990.

Mr. Chairman and Members of the Subcommittee:

It is a pleasure to appear before you today to discuss the issue of effective communications between pilots and air traffic controllers, the two most critical links in maintaining the safety and efficiency of our national airspace system. Accompanying me today are Mr. Norbert A. Owens, our Deputy Associate Administrator for Air Traffic, and Dr. H. Clayton Foushee, the FAA's Chief Scientific and Technical Advisor for Human Factors.

Effective communications between pilots and controllers have been an ongoing concern to the aviation community since before the radio became the primary means of aircraft communications. Equally important, in our view, is the use of effective communications to promote safety in the cockpit. We view each form of communication -- pilot/controller and pilot/first officer/flight engineer -- to be critical for the continued safety of our national airspace system.

The FAA has been actively pursuing ways of improving communications between pilots and controllers. In the last two years alone we have made over twenty changes to the controller handbook to improve or clarify communications. In June 1989, the Air Traffic Management Team, of which Mr. Owens is a member, recommended that all air traffic control phraseology be reviewed and, if necessary, changed to improve clarity and understanding. As a result, forty specific recommendations were made and are undergoing a national review before being incorporated into our controller handbooks. In addition, there are several efforts underway at the FAA Academy to revise hearback/readback training for controllers and to strengthen overall controller communications.

As part of our ongoing concern about the use of effective communications, the FAA, the Department of Defense (DOD), and the aviation industry launched a nationwide communications awareness initiative in early 1988 entitled "A Call To Action". This initiative was designed to heighten the aviation community's awareness of the need for effective communications to reduce system operations problems, increase user professionalism and enhance system safety. The initiative focused on twelve areas of concern ranging from similar sounding alphanumerics and controller hearback problems to initial radio contact, stuck microphones and readback problems. The distribution of "A Call to Action" was worldwide, with copies provided to ICAO and several foreign countries as well as our entire air traffic controller workforce. The pilot community's distribution was handled by various user organizations and the FAA's Flight Standards Offices.

The twelve areas of concern identified in "A Call to Action" represent those that most commonly affect communications between the pilot and controller. I would like to stress, however, that the initiative was not an attempt to provide solutions to problems that are extraordinarily complex but was intended to raise the level of awareness within the entire aviation community of the extent of the communications problems facing pilots and controllers. It should also be made clear that we were seeking solutions to these problems prior to this initiative. The hearback/readback problem has received perhaps the most attention, with the publication of several air traffic service bulletins, special emphasis programs and meetings with user organizations.

Having identified some of the more common communications problems, the next step logically involved seeking their causes and continuing our work to develop solutions. Before outlining our approach to seeking long-term solutions, it is important to understand that effective communications also involve cockpit communications. Communication among the flight crew members is just as critical to aviation safety as pilot - controller communications. To address this problem, we have encouraged industry development and implementation of cockpit resource management (CRM) programs, which I will highlight later.

We view the spectrum of communication problems as being within the broader context of what has become known as human factors. I think we all can agree that we are just beginning to fully comprehend the dimensions of human factors in aviation. It is clear that we have not done enough to apply human factors to aviation environments, and in many cases we have not invested in the research necessary to systematically understand the dimensions of the human part of the issue. We now appreciate much more that human factors are central to all aviation safety activities.

Human factors problems have, of course, been with us for a long time. The facts speak for themselves. Human error has been a causal factor in 66 percent of fatal air carrier accidents; 79 percent of fatal commuter accidents; and 88 percent of fatal general aviation accidents. Communication misunderstandings, one type of human error, are a major factor in operational errors, as this Subcommittee well knows. The root causes of human errors, however, are poorly understood. That is why we are pleased to have Dr. Foushee with us at the FAA, as our resident human factors expert. He comes to us after a distinguished career at NASA and is internationally recognized as an expert in this field.

Partially as a follow up to the "Call for Action" initiative and as a result of our recognition of the importance of human factors, we have begun an effort to focus on human factors relating to controller and pilot errors. This effort will research, identify, and establish a course of action related to pilot and controller errors. As causes are identified and solutions proposed, they will be forwarded to our human factors coordinating committee to discuss implementation or support further research. When project development begins, benchmarks will be determined for full implementation.

This effort began in March of this year, and Mr. Owens and I both participated. The first issue that was addressed concerned controller operational errors caused by pilot readback errors which the controller did not hear. Such readback errors also lead to pilot deviations. To counter those errors, we are currently studying all aspects affecting transmission and receipt of messages in the control room and the cockpit. We will continue to examine possible solutions to pilot/controller communications problems.

With regard to the issue of English as a second language, earlier this week we polled several of our regions, which handle large numbers of foreign air carriers. English as a second language was not perceived as a significant problem by these air traffic facilities, since our controllers give special attention to communications from foreign air carrier pilots.

As I noted earlier, the other critical area where effective communications must be maintained is in the cockpit between the flightcrew members. Since 1979, an increasing amount of evidence has shown that nearly eighty percent of air carrier accidents and incidents resulted in part from a failure by the flightcrew to make full use of readily available resources. A long-term NASA research program noted that these accidents and incidents had many common characteristics. The NASA research pointed out that the problems confronting flightcrews had little to do with the technical aspects of aircraft performance. Instead, they were associated with poor group decision making, ineffective communication, inadequate leadership, and poor management. In addition, airline training programs focused almost exclusively on the technical aspects of flying and did not take into account flightcrew management strategies and techniques for managing a crisis in flight.

As a result, both government and industry began to realize that more training emphasis was needed on human factors that influence flightcrew coordination and resource management. Briefly defined, CRM is the effective utilization of all available resources--hardware, software, and people--to achieve safe and efficient flight operations. In December 1989, the FAA issued an advisory circular to further encourage air carriers to develop CRM training programs and to provide basic guidelines for such training.

The advisory circular indicated that CRM training programs should include, at a minimum, an awareness phase, a practice and feedback phase, as well as a continual reinforcement phase where CRM principles are addressed on a long term basis. We further defined CRM in the advisory circular as being a comprehensive system for improved flightcrew performance which is designed for the entire flightcrew population; extends to all forms of flightcrew training; concentrates on attitudes and behaviors of flightcrew members and their impact on safety; provides an opportunity for individuals to examine their own behavior and make individual decisions on how to improve cockpit teamwork; uses the flightcrew as the unit of training; and requires the active participation of all cockpit crewmembers.

As with the solutions being sought by the Pilot/Controller working group, behavioral change from CRM training cannot be accomplished in a short period, even if the training is well designed. Flightcrew members will need time, awareness, practice and feedback, and continued reinforcement to learn lessons that will endure. We nevertheless are encouraged that CRM will go a long way toward improving flightcrew communications skills.

In addition to CRM, I would like to briefly mention two other innovative training programs that have a direct bearing on improved communications as a safety management resource: Line Oriented Flight Training (LOFT) and the Advanced Qualification Program (AQP).

The advent of sophisticated simulator training devices has greatly enhanced training of flight crewmembers by air carriers. LOFT is a useful training method because it gives flight crewmembers the opportunity to practice line operations with a full crew in a realistic environment. LOFT training allows flight crewmembers to handle a variety of scripted real-time scenarios, which include routine, abnormal, and emergency situations. They also learn and practice cockpit resource management skills, including crew coordination, judgment, decision-making, and communications skills.

The Advanced Qualification Program (AQP) is an alternate means of qualifying, training, certifying, and otherwise ensuring the competency of flight crewmembers. Its objective is to provide more effective training to enhance professional qualifications to a level above that currently provided by the standards specified in FAR Parts 121 and 135. The concept of AQP encourages certificate holders and recognized training centers to develop innovative training and qualification programs that incorporate the most recent advances in training methods and techniques, including simulators and other computer-based training devices.

Since improved and heightened communications awareness, cockpit resource management, LOFT training, AQP and virtually every aspect of FAA's safety responsibilities involve human factors, I would now like to provide you an overview of our national human factors program.

Our national human factors program will be comprehensive in scope and will include research aimed at the alleviation of human performance problems in all types of aircraft, in the air traffic control environment, and in the interaction of the two environments. It is intended to encompass both the operational and maintenance spheres of each environment. The national plan has eight major research priorities:

1. Automation and Advanced Technology -- While automation eliminates some classes of error, it can introduce new types of errors, if not properly designed.

2. Aviation System Monitoring Capability -- Human factors research is dependent on compiling good data in the operational environment.

3. Basic Scientific Knowledge of Human Performance Factors -- We must invest in the pursuit of basic knowledge and specific applications to arrive at human behavior answers.

4. Human Performance Measurement -- There exists a need for the development of better research methodology and techniques for measuring human performance.

5. Information Transfer -- What are the most efficient and reliable ways to exchange information, what information should be available to each, and when.

6. Controls, Displays, and Workstation Design -- Applying human factors techniques to the design and evaluation of controls and displays.

7. Training and Selection -- What training methods and selection criteria are needed to produce the best possible personnel.

8. Certification and Validation Standards -- How do we translate the products of this plan into concrete certification and validation guidelines?

While this entire effort will by directed and coordinated by Dr. Foushee, it will be the product of a joint partnership between the FAA, NASA, DOD, the airline and manufacturing industry, and the academic community.

Much of the impetus for our national human factors program was the Aviation Safety Research Act of 1988, which authorized increased funding for human factors research. In addition, the Air Transport Association established a human factors task force, made up of government, industry, and scientific representatives, which was a driving force in helping us identify the priorities for our human factors plan.

While there has been considerable attention paid over the years to human factors research by FAA, NASA, DOD, and academia, these efforts have not been systematically coordinated. What is fundamentally different today is that government and industry managers and decision makers perceive that society may be nearing a point of diminishing returns on investments in technology, making investments aimed at the human element far more attractive. We also have a high level of interest and commitment in Congress and Executive agencies, as well as agreement among researchers and the operational community, as to what the human factors research priorities are and how to go about addressing them.

As I mentioned earlier, we have established in the FAA a human factors coordinating committee, chaired by Dr. Foushee and comprised of a representative from each of our major operational components -- flight standards, air traffic, airway facilities -- as well as our research and development organization. The human factors coordinating committee is the focal point for all human factors initiatives. It formulates policy recommendations to the FAA Executive Board to ensure that appropriate research and development is accomplished and that research and development products are being appropriately applied to FAA operations.

In fact, in the ten-year period prior to enactment of the Aviation Safety Research Act, the FAA has spent nearly $60 million in human factors research and development, and the fruits of those efforts can be seen in many of our major systems acquisitions. In our fiscal year 1991 budget request we are seeking $17.2 million for human factors research. This sum represents the human systems and aviation medicine portion of our budget, but many of our facilities and equipment efforts have large human factors components so the actual total is significantly larger. We view this research and development budget request as essential to our human factors programs in 1) flight crew and air traffic controller performance, 2) the role of the human operator in automated systems, 3) selection, training, and certification of flight crew and air traffic controllers, 4) enhancing understanding of the human function in the complex air traffic control and cockpit environments, and 5) increasing productivity and safe performance of agency personnel through application of human factors research.

In closing, I would like to note that the FAA, other government agencies, academia and industry are now in the midst of a unique opportunity to begin addressing the broad array of human performance issues. I would like to assure this Subcommittee that the FAA is committed to the development of human factors criteria to enhance and improve aviation safety.

Mr. Chairman, that concludes my prepared statement. Mr. Owens, Dr. Foushee and I would be pleased to answer any questions you might have.

AVIATION INDUSTRY

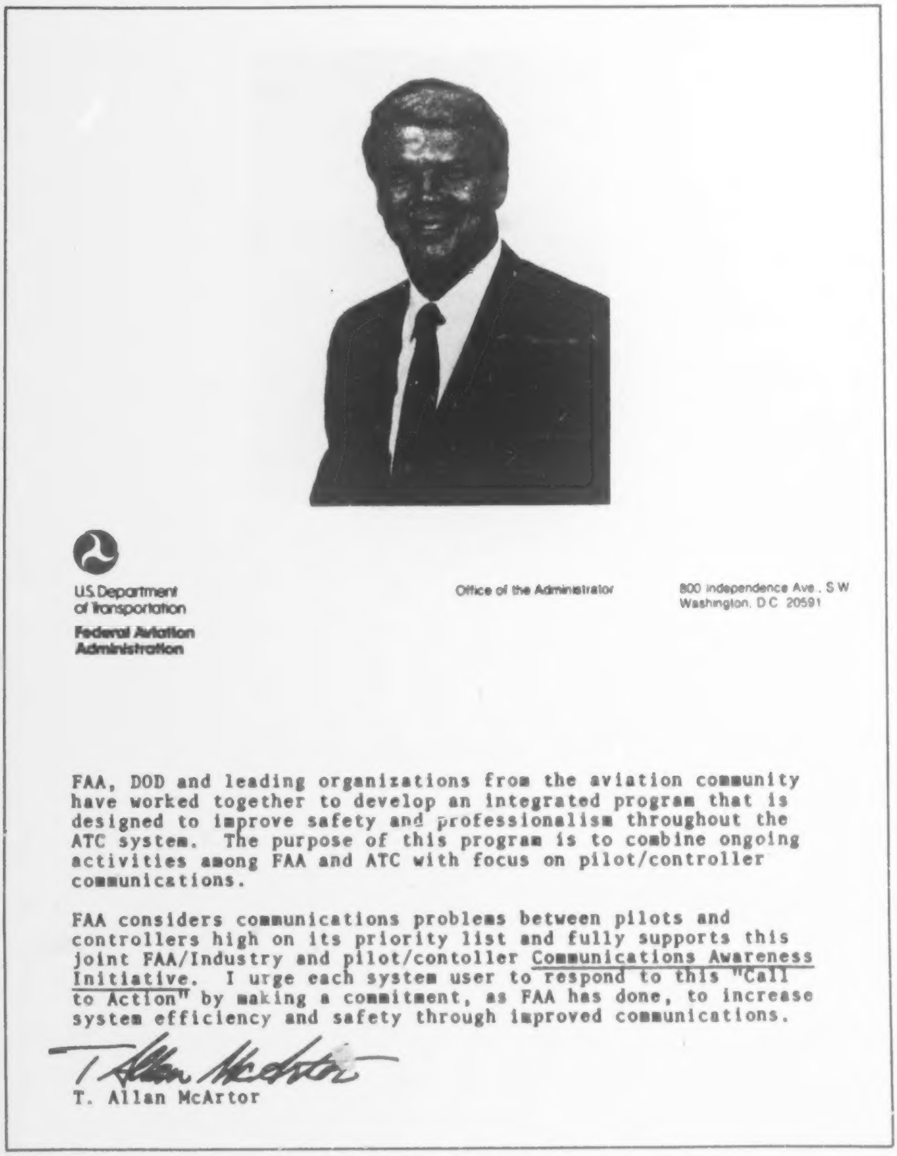
A

CALL TO ACTION

PILOT/CONTROLLER COMMUNICATIONS AWARENESS

A JOINT FAA INDUSTRY PARTNERSHIP
TO IMPROVE PILOT/CONTROLLER
COMMUNICATIONS

1988



U.S. Department
of Transportation
**Federal Aviation
Administration**

Office of the Administrator

800 Independence Ave., S.W.
Washington, D.C. 20591

FAA, DOD and leading organizations from the aviation community have worked together to develop an integrated program that is designed to improve safety and professionalism throughout the ATC system. The purpose of this program is to combine ongoing activities among FAA and ATC with focus on pilot/controller communications.

FAA considers communications problems between pilots and controllers high on its priority list and fully supports this joint FAA/Industry and pilot/contoller Communications Awareness Initiative. I urge each system user to respond to this "Call to Action" by making a commitment, as FAA has done, to increase system efficiency and safety through improved communications.

T Allan McArtor

T. Allan McArtor

INTRODUCTION

For years now, industry has been increasingly concerned about the issue of effective communications between the providers of the nation's air traffic control system and the users. As a means of promoting industry awareness and sensitizing all participants of the system to the issue of communications, the Air Traffic Procedures Advisory Committee (ATPAC) --the FAA Administrator's sponsored committee consisting of representatives from 15 user organizations -- promulgated a recommendation that the FAA develop a plan to promote pilot and controller awareness in this vital area of interactive communications.

This brochure represents the combined efforts of the Initiative Working Group consisting of the FAA and 12 collective industry organizations as part of a nationwide program to increase awareness of the communications problems that are impacting the system.

The Working Group responsible for the development of this program convened on numerous occasions to establish a comprehensive plan to promote this awareness initiative and are cited for dedicating valuable time and resources towards the success of this program.

ALPA	Captain Tom Kreamer, Ward Baker
ATCA	Amy Kauffman
AOPA	Shelby Harrod
ASF	Dick Gless
ATA	Dan Schillaci
Denro	Peter Prutzman
GAMA	Susan Gordon
NAATS	Bruce Henry
NATCA	Larry Barbour
NBAA	Paul Smith
NASA/AMES	Donald George
USAF	LTC Robbie Linn
FAA-Air Traffic	Paul Strybing, Willie Card

PILOT/CONTROLLER COMMUNICATIONS AWARENESS

STATEMENT OF PURPOSE

Comprehensive in scope and industry appeal, this initiative was founded on the demonstrated need to foster improved communications between pilots and controllers as a means of reducing system operations problems, increasing user professionalism and enhancing system safety. An ambitious objective -- but one that can be achieved through the recent partnership founded between the overwhelming number of system user organizations represented in the Working Group actively promoting the program, and the FAA. The cooperative Pilot/Controller Communications Awareness Initiative includes this effort which will address twelve specific areas of concern identified by the ATPAC and endorsed by the FAA and the Working Group organizations.

Recently, FAA Administrator T. Allan McArtor officially endorsed the ATPAC recommendation, and a nationwide program to promote this communications awareness initiative has been developed by the Working Group which consists of eleven industry associations, DOD/USAF representatives and FAA Air Traffic personnel.

An extensive information campaign will be implemented in cooperation with the FAA's Back-to-Basics ongoing program throughout October, November, and December of 1988, with special events, publications, and focused media attention to the various communications problems evident in the system which will receive concentrated attention during November.

This aviation community sponsored publication, "A Call to Action: Joint FAA/Industry Partnership to Improve Pilot/Controller Communications," provides an overview of each of the twelve vital areas for improvement and will be widely distributed throughout the aviation community. The objective of this brochure, in addition to providing a visible display of overwhelming industry unity to address systematic problems affecting all of us, is to facilitate sensitivity, vigilance and awareness of the communications link between controllers and pilots and to prompt resolution of many of the problems plaguing the ATC system.

In addition to sponsoring distribution of this brochure, the program coordinators intend to capture a large audience of controllers and pilots through the distribution of educational materials; incorporation of issues of concern into industry training programs; extensive media coverage/promotion (posters, handbooks, articles, press releases, etc.); seminars; industry convention participation; and other information outlets.

This Call to Action is exactly that -- an appeal to each and every member of the aviation community to respond to the need for improved communications as a means of enhancing both system safety and system performance.

INDUSTRY PERCEPTIONS

Both pilots and controllers are taught that effective communications can only result from a continuous loop process whereby the sender of the message and the receiver of that message share the same information. We in the aviation community have for many years strived to establish and maintain this continuous loop with some measure of success; however, as the system continues to grow and reach capacity, the demands upon the communication loop have increased significantly, weakening the loop and escalating the need for improvements in the area of verbal communications.

A review of system performance indicators, such as operational errors, pilot deviations, and accident/incident reports, illustrates the need for improvements on a national scale. The single common denominator in an overwhelming percentage of incident and accident studies cited the breakdown in communications between pilots and controllers as a causal factor. Historical data collected via NASA's Aviation Safety Reporting System (ASRS) indicates that approximately 80% of the reports filed by pilots and controllers over the past three years reference ineffective information transfer via verbal communications.

As professionals -- both in providing and using the services of the nation's air traffic control system -- it is our combined mission to strive for perfection in the area of communications and dedicate our resources to attain this objective. The fact that air transportation in the U.S. remains the safest mode of transportation is not enough. The professional pilots and controllers supporting the ATC network have the resources and abilities to not only maintain, but to improve this reputation of providing the highest level of safety and efficiency, and each must assume responsibility to undertake the task of resolving the communications problems impacting the nation's air safety record. Future integrity of the ATC system will depend upon our success on an industry-wide basis in identifying and resolving the specific communications problems.

The industry Working Group that was formed to identify the significant communications areas of concern wholly embraces and endorses a national program of increased awareness of the problems plaguing the system and does not profess to have the solutions to these problems. Instead, the objective of this initiative is to focus the attention of each and every pilot and controller on the topic of communications as a means of removing the breakdown potential at its source rather than trying to resolve the issue after it has become a problem. The fact is that basic common sense and the use of existing procedures and techniques will produce immediate, measurable, results by eliminating or reducing the risk of a communications-loop breakdown. Intensive studies, complicated resolutions, and technological changes will in no way provide any measurable benefits unless we, as a collective industry, stand by our commitment to professionalism and incorporate the elementary rules of basic communications techniques as part of our daily performance. Any lack of commitment or dedication of resources to the awareness of our communications problems threatens the future efficiency and safety record of the nation's most valuable transportation resource -- our air traffic control system.

Members of the Initiative Working Group are convinced that each of these areas of concern, which recur in the system on a daily basis, can be mitigated through increased vigilance and awareness and have pledged to commit the collective resources of the organizations that they represent to promote this objective.

There is no other entity more concerned with, or interested in, the success of the nation's ATC system than those who regularly operate within, or provide operational support for, the system. No other entity is better qualified to critique or assess the system than the professionals who provide and use the ATC system. To this end, the Industry Working Group has identified areas that need improvement and has issued an appeal to the entire aviation community for action -- immediate action -- to increase system efficiency and safety through communications awareness.

The objective is simple: If each and every pilot and controller would recognize the twelve areas of concern that are contained in this document and takes action to eliminate the occurrence of a particular problem existing in his or her verbal communications loop, this effort will be successful and we, as an industry, will enjoy immediate benefits and will move ahead in our quest to eliminate communications breakdowns via a concentrated step-by-step process.

PILOT/CONTROLLER COMMUNICATIONS AWARENESS

CALL FOR ACTION

This professional group of aviation users and providers sees the urgent need for a joint effort to concentrate and support an initiative to promote pilot and controller awareness to enhance and improve communications. There have been special emphasis programs in this area before. However, the users and providers of the ATC system believe that this communications awareness program can be very effective as a result of the collective partnership that will unite the users and the providers in one organized effort to address these issues. The twelve areas of concern and focused initiative are:

- Similar Sounding Alphanumerics
- Controller Hearback Problems
- Phraseology
- Enunciation
- Headsets Versus Speakers
- Radio Discipline
- Intra-cockpit Communications
- Controller Intercoordination Communication
- Blocked or Simultaneous Transmissions
- Stuck Microphones
- Readback Problems
- Initial Radio Contact

Each of these areas of concern is addressed in the pages that follow.

SIMILAR SOUNDING ALPHANUMERICS

STATEMENT OF THE PROBLEM: One of the more predominant communications problems impacting ATC and flight operations, especially in busy terminal areas, is the confusion resulting from similar sounding call signs or duplicative control instructions issued to similar aircraft types. Instances of control instruction and clearances being issued to the wrong aircraft are common throughout the system, especially when multiple air carrier companies are operating on the same frequency with similar flight numbers, or multiple general or business aviation aircraft are operating the same equipment using the same frequency.

BACKGROUND AND HISTORY: Unprecedented traffic growth within the system over the last five years has resulted in significant increases in the number of operational errors and system deviations resulting from confusion relating to similar sounding alphanumerics call signs. The implementation of airline hubbing programs has greatly affected the system by introducing large banks of traffic arriving or departing an airport during a short period of time, usually by the same carrier, and generally of a type where consecutive or similar flight numbers are used. Under the circumstances, it is easy to appreciate how flight numbers, trip numbers, aircraft types and aircraft call signs can be transposed or misread by controllers and that control instructions properly read can be misinterpreted by pilots.

SPECIFIC EXAMPLES OF PROBLEMS: An excerpt from the Air Safety Foundation's periodical for flight instructors illustrates an operational error initiated by a pilot using incorrect call signs. Picture this: traffic is stacked up in the approach-fix holding pattern. In the stack are Cessna N1523Q and Beech N28223Q. The controller shortens the aircraft call signs to "23Q", and the pilots-in-command do not catch the potential error of duplicative signs. Cessna 23Q accepts a clearance intended for Beech 23Q, and acknowledges "23Q, Roger". The controller does not catch the error (hearback problem) and an operational error ensues.

POTENTIAL SOLUTIONS/PREFERRED TECHNIQUES: Recently, FAA distributed a Letter to Airmen as well as internal notices to the controller work force on the topic of aircraft call signs as a means of promoting increased awareness of problems resulting from similar sounding alphanumerics and call signs. The Letter to Airmen is included below to reinforce the procedures and phraseology used by controllers and pilots set forth in the Airman's Information Manual (AIM) and the Controller Handbook (7110.65).

"This letter solicits your cooperation and assistance in prefixing all ATC communications with your aircraft type, model, or manufacturer's name. Use of call signs that are too brief or, worse, not including your call sign in radio requests or acknowledgements can lead to confusion. Because number and letter call signs can often sound similar, prefixing your call sign with your aircraft type or model or manufacturer's name is the extra insurance that may prevent you from taking another aircraft's instruction/clearance and prevent a controller from thinking you acknowledged for an instruction when someone else takes your instruction.

Excerpted below are the requirements controllers have to follow concerning aircraft identification during radio exchanges.

2-87 AIRCRAFT IDENTIFICATION

Identify aircraft as follows: use the full identification in reply to aircraft with similar sounding identification. For other aircraft, the same identification may be used in reply that the pilot used in initial callup except use the correct identification after communications have been established.

2-87 Reference. - Abbreviated Transmissions, 2-77.

a. Civil - State the aircraft type, the model, the manufacturer's name or the prefix "November" followed by the numbers/letters of the aircraft registration.

2-87a Examples. -

"Jet Commander One Four Two Four"
"Douglas Three Zero Five Romeo"
"Bonanza One Two Three Four Tango"
"November One Two Three Four Golf"

2-87a(1) Examples.

"American Fifty-two"
"Delta One Hundred"
"Eastern Metro One Ten"
"General Motors Thirty Fifteen"
"United One Zero One"
"Delta Zero One Zero"

2-87a(1) Note.

"Group form" is the pronunciation of a series of numbers as the whole number, or pairs of numbers they represent rather than pronouncing each separate digit. The use of group form may however be negated by four digit identifiers or the placement of zeros in the identifier.

If aircraft identification becomes a problem when the procedures specified in (1) are used, the call sign shall be restated after the flight number of the aircraft involved.

PILOT/CONTROLLER COMMUNICATIONS AWARENESS

2-87a(2) Examples.

"American Five Twenty-one American"
"Commuter Six Eleven Commuter"
"General Motors Thirty-seven General Motors"

Your inclusion of an appropriate prefix will help the controller to stick to his required phraseologies and will further help ensure that confusion or misinterpretation are kept to the lowest possible minimum."

Additionally, pilots can assist controllers with the effective transmittal of control instructions and clearances by reviewing and becoming familiar with the contents of the Airman's Information Manual (AIM), paragraphs 193, 260, and 290 which describe proper call sign designations, appropriate phraseology, and preferred technique. Pilot knowledge of these procedures will promote automatic rote response to controller requests. A rote response will be especially valuable when operating in high traffic areas when pilot workload is high and concentration on the proper phraseology and call sign can be distracting.

CONTROLLER HEARBACK PROBLEMS

STATEMENT OF THE PROBLEM: The term "hearback", and the problems associated with the term refer to instances when the controller has difficulty in repeating, hearing and fully understanding what a pilot says when reading back a clearance, issuing instructions, or providing information.

BACKGROUND AND HISTORY: The problem has existed since radios were first put into aircraft for the purpose of controller/pilot communications. At first the quality of the radios had a great deal to do with the problem. Today radio quality is significantly better, but poor quality of voice transmission still plays a part in this problem. Weather, near a transceiver site or near an aircraft, can also greatly affect the quality of transmissions.

SPECIFIC EXAMPLES OF PROBLEMS: One of many contributing factors prompting hearback problems is ambient noise. We all know what noisy and distracting places some towers and centers can be. Usually they are not, but may sound this way to an outsider. When they are noisy, however, this can make it difficult for controllers to hear what a pilot or another controller is saying. During these times it is doubly important for controllers to be certain that they have heard the message correctly.

Another factor affecting "hearback" is probably the most difficult to resolve. We are all human and sometimes hear what we want to hear. A controller asks for a report leaving five thousand feet during a descent. (The controller probably has conflicting traffic at six thousand feet.) The pilot later reports leaving nine thousand feet, but the controller hears five thousand because that is what he wants to hear and expects to hear.

Another cause of controller hearback woes is the fact that many center controllers now work alone and are not monitoring the frequencies exclusively. Whereas in the past, there was a radio controller, a second controller responsible for inter- and intra-facility coordination, and a third to do paperwork. Now there is one controller doing all three jobs simultaneously. In some centers this situation exists 75% of the time. Pilots should be aware of this in the event that an immediate reply -- or no reply -- from a controller is forthcoming, especially after the pilot reads back a lengthy clearance. In this case, you, the pilot should question the controller to make sure he heard your readback. He may have been called away to answer a land line as you were speaking.

POTENTIAL SOLUTIONS/PREFERRED TECHNIQUES: Controllers must be vigilant to ensure that they hear correctly what the pilot said, not what they wanted to hear. In noisy or confusing circumstances they must be extra careful to practice good listening skills.

Pilots must ensure that the controller heard, repeated and understood what was said. If either party has any doubts about what was or was not heard, it is important to initiate clarification or repeat the readback.

PHRASEOLOGY

STATEMENT OF THE PROBLEM: Of the numerous communications problems evident throughout the ATC system the most common and troublesome is the improper use of established and recommended phraseology by pilots and controllers. On overwhelmingly large number of daily incident reports are directly attributable to the use of improper phraseology which has resulted in a miscommunication on the part of both controllers and pilots.

BACKGROUND AND HISTORY: It has been well over 25 years since the FAA developed a Pilot/Controller Glossary as a means of establishing an industry standard for ATC communications and these definitions and descriptions of terms has done an adequate job of providing a reference to pilots and controllers alike. As the operational characteristics of the system evolved, the phraseology handbook was forced to keep up with changing demands of modified procedures, aircraft, operating techniques and new technology. The dynamics of the phraseology currently included in the glossary today has been developed through extensive coordination between FAA and system users to provide optimumly balanced terms of reference available for use by system users and system providers with comparable levels of acuity. This glossary, when used in combination with the controller's handbook and the AIM, is the system standard and is only as effective as each individual's knowledge and familiarity with the terms therein. Unfortunately, a significant number of system users do not use the phraseology dictated in the three primary documents and this absence of technique and knowledge has a detrimental impact on the efficiency and safety of the ATC system on a daily basis.

SPECIFIC EXAMPLES OF PROBLEMS: Improper phraseology resulting in communications breakdown is not isolated to any specific segment of pilots or controllers nor to an operational scenario. Phraseology problems occur in every imaginable situation: readbacks, hearbacks, initial radio contact, clearance instructions, pilot requests, position reports, weather advisories, traffic advisories, etc.

POTENTIAL SOLUTIONS/PREFERRED TECHNIQUES: One very effective way to reduce the communications problems caused by improper use of phraseology is for both pilots and controllers to know and use the standard terminologies prescribed in the Pilot/Controller Glossary -- for controllers, Appendix A, of the handbook. It is the last section in the AIM.

ENUNCIATION

STATEMENT OF THE PROBLEM: English is the official language of aviation, but unfortunately we don't all speak the language with the same clarity and understanding. The problem can be defined by the fifty-cent word enunciation. But for some of us, maybe that word doesn't fully communicate the problem. What we're really talking about is not what we say but how we say it. In examining how we talk on our radios we must look at the common enunciation errors which contribute to miscommunication. These errors include voice volume, rate of speech, voice inflection, and similar sounds.

BACKGROUND AND HISTORY: We can all think back to our younger days when one could determine that mother was talking long distance because she always felt compelled to yell into the phone. Or, how about those tin cans with waxed strings we all used in our childhood games? As the saying goes, we've come a long way. With today's radio technology we must remember that radios are electronic devices with built-in amplifiers and volume controls. With a properly positioned microphone, a normal speaking volume is all that's needed. Save the extra volume for the ball park or the kids.

The next enunciation error is the error of speech rate. We've all heard the overworked controller who talks very quickly to minimize the time required to issue instructions to a variety of aircraft. This is a practiced art which is not appropriate to most communication situations. High speech rates require increased attention on the part of both parties involved in the exchange of information. It only takes one "Say again all after..." to eliminate any time advantage gain by speaking too fast. This is particularly true when emergency situations arise and the use of calm, measured communications pays big dividends.

SPECIFIC EXAMPLES OF PROBLEMS: Voice inflection and accent can be a troublesome communication issue. A military pilot training story illustrates the humorous side of this problem. It seems there was an instructor pilot who sought to teach his foreign student the visual ground references for the traffic pattern by verbally referring to each reference as it was overflown. The instructor noticed that each time they overflew one of the most prominent references, a cotton gin, the student became confused and non-responsive. When questioned about this behavior after the flight, the student explained that he could not understand why the instructor kept advising him to "cut engine" when they weren't near the runway. If accents are involved extra care must be taken when talking and listening.

Finally, we must always be on the lookout for those similar sounding words and numbers. Controllers must remain diligent to warn pilots of aircraft on the frequency with similar sounding call-signs, just as pilots must be sure control instructions are meant for them before complying.

POTENTIAL SOLUTIONS/PREFERRED TECHNIQUES: What can be done to minimize the problems stemming from these enunciation pitfalls? First, realize your limitations. If you have an accent, remember it effects both your speaking and your listening. Second, properly adjust your radio equipment. This includes volume and microphone placement. Finally, when you open your mouth to speak use a normal speaking voice and proper phraseology to minimize the confusion of similar sounds.

Try to hear yourself as others hear you. If you haven't yet done so, tape record yourself making a few typical radio transmissions remembering to vary both the speed and volume of speech. Now play it back to get a feel for how others hear you. Are improvements needed?

HEADSETS VERSUS SPEAKERS

STATEMENT OF THE PROBLEM: The issue of the use of headsets versus speakers, and the effectiveness of communications using either method, is one of the controversies among system users. Generally, the majority of controllers and pilots prefer to use headsets, especially now that technological improvements have virtually eliminated cumbersome head gear. The communications problem results because pilots miss ATC instructions or requests when they use speakers. Also, controllers miss pilot requests while using speakers because of background noise or distractions.

BACKGROUND AND HISTORY: Review of NASA-Aviation Safety Reporting System (ASRS) reports filed between January 1, 1982 and June 29, 1988 reveal:

- o 29,647 completed forms cited communications problems involved in the incident reported
- o 13,356 abbreviated forms indicated communication problems existed which influenced the incident reported.

A large number of these combined reports cited the use of speakers as a factor in the incident report because the crew or controller were using speakers exclusively. Many pilots indicated missed clearances or control instruction due to not using headsets.

Most aircraft today, including general aviation, corporate, air carrier, and military, have provisions for the use of headsets in addition to speakers. Controllers have the same options. Try to imagine for a moment the distractions for controllers and pilots:

Controller - cross-over reception from another controller's speaker, static, background conversations, coordination of handoffs or traffic from one controller to another, plus speaker failure.

Pilot - engine noise, rain on the windshield, ice pellets, ambient cockpit noise, crewmember conversation, interruptions from flight attendants, and speaker failure.

Each of these distractions interrupt the flow of information through the communications link and have been documented not only via NASA-ASRS reports but through other industry safety indicators as well.

SPECIFIC EXAMPLES OF PROBLEMS: A brief summary of one incident report follows:

> "(Air Carrier) cleared to 10,000 feet I became uneasy because we were flying in the clouds ... heading directly for mountains ... requested co-pilot ask ATC for higher altitude ... understood cleared to FL310 ... immediately initiated climb ... as climbing through 12,500 feet, controller said 'Say Altitude' ... I reported cleared to 12,500 feet ... controller responded clearance limit was to 10,000 feet ... at that moment we entered VFR conditions and saw a medium/large transport aircraft less then 3/4 of a mile distance going away from us ..."

In the final account of this report the filing pilot indicated the following:

> "The cabin speaker was not clear enough to allow a full understanding of all words spoken and I missed essential instructions"

In another incident:

> "we were given a delaying vector. After several minutes we did not receive another clearance inbound to ABC airport. I made a comm check and discovered that the receiver was turned all the way down. I turned the speaker up and called the ARTCC. The controller had been trying to contact us for 20 miles."

POTENTIAL SOLUTIONS/PREFERRED TECHNIQUES: Most assuredly pilots and controllers have their own preferences as to individual use of speakers verses headsets. However, it is becoming common for communications problems to occur more frequently with those individuals using only speakers. One thing to consider if personal preference dictates the use of a speaker for communications is that there is an empty gap between the source of the clearance or control instruction to the ear. With the headset -- there is a direct line.

PILOT/CONTROLLER COMMUNICATIONS AWARENESS

RADIO DISCIPLINE

STATEMENT OF THE PROBLEM: Poor technique by pilots and controllers in the application of radio discipline tends to confuse and frustrate the ATC system. Those who act as though they are the only ones in the system, demanding immediate attention, appear oblivious to the effects of their actions. When sound radio discipline principles are not followed, the effects can range from minor localized confusion to far-reaching disruptions of untold consequences. All participants must become acutely aware and alert to improving their radio discipline, knowledge and skills.

BACKGROUND AND HISTORY: It is well known that communication is a basic requirement for maintaining a safe, efficient air traffic system. In today's ATC environment, radio is the primary means of relaying messages, instructions, clearances, and acknowledgements between controllers and pilots. System architects have historically stressed the requirement that both sender and receiver use sound radio discipline prinicples that promote understanding by all concerned.

SPECIFIC EXAMPLES OF PROBLEMS: Radio discipline can best be defined as an orderly, prescribed pattern of behavior used when communicating by radio. Two examples of bad radio technique that make a communicator stand out as less than professional might include:

- Keying the microphone and speaking before the appropriate time interval for listening on the frequency, therefore "stepping on" another transmission.
- Beginning to speak before the radio transmitter is fully engaged, resulting in "a clipped transmission" or missing words that may render a communication useless.

POTENTIAL SOLUTIONS/PREFERRED TECHNIQUES: There are three simple principles to follow in developing a professional attitude towards sharpening your radio discipline skills. By adhering to the following principles, all system users help promote understanding in pilot-controller communications:

1. Maintain the efficiency of each transmission:
   - Be as brief as possible
   - Eliminate unauthorized transmissions
   - Speak clearly
   - Speak at a rate appropriate to the situation
2. Use proper radio techniques:
   - Listen before transmitting
   - Think before keying transmitter
   - Use the microphone properly
   - Be alert to sounds or lack of sounds in receiver
   - Know the capabilities of the equipment
3. Standardize all communication to the extent possible:
   - Use the phonetic alphabet
   - Use appropriate aircraft call-sign procedures
   - Utilize the proper convention when communicating figures such as altitudes; flight levels; directions; and time

Chapter 4, Section 2 of the AIM and Chapter 2, Section 4 of the Controller Handbook give detailed explanations of items listed above.

Controllers and pilots have learned the above principles, yet they are not always practiced. To ensure that this vital link between pilots and controllers remains unbroken, continuous review is required to help sharpen our communication skills. Don't be caught demonstrating amateur quality techniques when a reasonable effort can achieve professional quality radio discipline.

INTRA-COCKPIT COMMUNICATIONS

STATEMENT OF THE PROBLEM: What could be more simple? One would believe it not possible to have a communications problem or information transfer problem when only two or three people are present in the cockpit and are "communicating" among themselves.

A very basic problem can exist when the non-flying pilot miscopies a critical ATC clearance and the flying pilot does not catch the mistake; an example being a miscopied altitude restriction without a complete readback and the non-flying pilot then selects the "wrong altitude" in the altitude alert window. Had a full readback occurred, this mistake could have been identified and a potential incident avoided.

Most pilots, and controllers as well, feel they are the best at what they do. Unfortunately, that very same feeling can lead to problems if a particular pilot feels he or she need not be part of a crew or team.

BACKGROUND AND HISTORY: A review of the NASA/ASRS database indicates intra-cockpit communication patterns seem to be significantly related to performance. The lack of appropriate communications between cockpit crew members is a problem, but also the style of communications plays an important role.

SPECIFIC EXAMPLES OF PROBLEMS: Of the reported intra-cockpit communications difficulties received by NASA, 35 percent cited problems with crew coordination dealing with poor understanding and division of responsibilities.

A total lack of communication between cockpit crew members was cited as a factor in 12 percent of the reports, and there were many examples of cockpit crew members not communicating regarding errors even when they had access to the correct information.

In a number of reports, communications between cockpit crew members were deficient as a result of over-confidence and complacency--assumptions that everybody understood what was taking place, when in reality they did not.

In several reports, a lack of confidence in subordinate crew members caused captains to become overloaded by trying to do too much. Over 15 percent of the reports dealt with information which was believed by one or more crew members to have been transferred, but for one reason or another was not.

Example:

> "I was monitoring an autopilot single autoland approach on flight ... to Runway 22L at EWR in visual conditions when a GPWS "pull-up" warning occurred ... the entire crew's attention was directed to confirming configuration position, speed, and sink rate, all of which were normal. I commanded, and simultaneously with the copilot, selected 50 degree flaps, considering that the landing flaps were not in the selected mode was possibly the reason for what I considered to be "probably" a false warning, due to a possible failed flap position switch. The FE said something

> which I could not clearly grasp while the "pull-up" was sounding. As the flaps extended to 50 degrees, the GPWS warning silenced. A normal auto landing occurred. Sounds simple and somewhat everyday -- until during taxiing I was informed that the FE had "inhibited" the GPWS without being commanded to .... He stated he asked me if I wanted it cancelled, but I didn't reply so he assumed I did."

As illustrated, there are numerous pitfalls in our search for the perfect flight, not only from what you have read so far, but including interference with pertinent cockpit communications by extraneous conversation between crew members or between crew members and flight attendants, as well as personality conflicts creating undue stress to the point that communications between crew members have completely deteriorated.

POTENTIAL SOLUTIONS/PREFERRED TECHNIQUES: We, as individuals, must remember to work together with others as a "crew"; to share in the responsibilities of our duties and execute those responsibilities in a proper fashion.

There are ways to help augment our communicating skills, and it is important for each of us to strive to always improve these skills. By using the tools inherent in resource management, clearly and explicitly conveying clearances and checklist items, always using full call signs and readback of clearances, questioning a clearance if in doubt, and avoiding complacency, pilots and controllers alike will improve communications. These are but a few of the techniques that can be used to make each and every flight a safe flight.

Proper communications – there is no substitute.

CONTROLLER INTERCOORDINATION COMMUNICATION

STATEMENT OF THE PROBLEM: By nature of the job characteristics communications coordination between controllers has historically been fraught with problems and pitfalls. Three- and four-way hookups (three or four controllers on the same line unknowingly) have caused internal controller communication problems. At times, written coordination is interpreted differently than intended, also causing difficulties. Even sign language is sometimes misinterpreted.

BACKGROUND AND HISTORY: There are specific guidelines for Controller coordination in Appendix C of the Air Traffic Controller Handbook (7110.65) for transfer of radar identification (handoff, point out, and traffic). Even if these guidelines are strictly adhered to, there are still some snags. The three- or four-way hookups can still cause headaches. In towers this is usually not a frequent problem, but in a center it is common. Controllers must be sure they are communicating with the proper person or they are wasting their time. Sector identity is very important; sectors are often combined, adding to the possibility of miscommunication.

SPECIFIC EXAMPLES OF PROBLEMS: Written coordination can become a problem when it is not correctly interpreted. Some strip marking is actually communication coordination between controllers. If facility strip markings guidelines are not followed, a pilot could be erroneously routed or given an improper altitude.

In towers and centers, sign language is often used. A controller is giving a lengthy clearance to a pilot and another controller wants to use a portion of the first controller's airspace. The second controller physically points to the aircraft on the first controller's radar scope and the first controller shakes his head "yes" or gives a thumbs up. He may have been shaking his head "yes" because the pilot read the lengthy clearance back properly. The same thing can take place in a tower when a local controller is asked if an aircraft can cross the active, when he is really saying "yes" to a cup of coffee.

POTENTIAL SOLUTIONS/PREFERRED TECHNIQUES: Each type of coordination has a place and can effectively communicate what the controller desires. The controller must be aware of the traps involved with each type of coordination communication. In some cases, miscommunication can be worse than no coordination at all.

BLOCKED OR SIMULTANEOUS TRANSMISSIONS

STATEMENT OF THE PROBLEM: Generally, simultaneous transmissions on the same frequency in proximity to the same intended receiver are frequent and self-defeating phenomena detrimental to effective communication of vital traffic movement and control information. Initiation of a transmission on an occupied frequency can (and does) result in vital information not being received by the intended ATC facility or aircraft.

BACKGROUND AND HISTORY: Disruption to voice communication in the ATC system presents the potential for degrading flight safety. Although these communication disruptions may occur in areas where traffic density is low, the growth of air traffic (and communication exchange) has increased the number of disruptive incidents.

In 1984, the FAA was petitioned to enact rulemaking to require anti-blocking circuitry that would preclude transmissions from activating on a frequency already in use. The FAA published the petition to the public comment and received favorable responses. Because an industry standard for such devices/circuitry is not available, FAA deferred action on the petition and asked the Radio Technical Commission for Aeronautics (RTCA) to establish a special committee to develop appropriate guidance and equipment standards. RTCA Special Committee 163 was formed to develop design guidance both for anti-blocking devices and for a means to terminate unintentional/ inadvertent continuous transmissions (stuck microphones).

Special Committee 163 met for the fifth in a series of sessions in May 1988. The committee refined and expanded second draft minimum operational performance standards (MOPS) for devices that will prevent ATC frequency blockage by unintentional prolonged radio transmitter keying (stuck mike) and simultaneous transmissions.

SPECIFIC EXAMPLES OF PROBLEMS: Paragraphs 191 -- Radio Technique and 235 -- Communications, stress the importance of listening before transmitting and of clearly communicating with ATC.

POTENTIAL SOLUTIONS/PREFERRED TECHNIQUES: The most basic human factors solution is for controllers and pilots to listen before transmitting on the frequency. Except for a few situations where some frequency overlap occurs, if someone else is talking on the frequency, keying the transmitter will be futile and will probably jam the receivers, causing the other transmitter to have to repeat and adding to frequency congestion. Equipment solution: RTCA Special Committee 163 efforts will culminate shortly for minimum operational standards for anti-blocking devices to be installed on aircraft through retrofit, modification, and/or via incorporation into new radios. Various levels of sophistication, technology, and costs will likely be considered. When the draft is finalized, it will be presented to the RTCA Executive Committee for review and approval and then to the FAA. Afterward, FAA will have to respond to the recommended standards, issue applicable NPRM's, resolve comments, and publish the final rulemaking.

STUCK MICROPHONES

STATEMENT OF THE PROBLEM: The pilot's microphone, a most vital link in the air-ground communications process, on too many occasions has been the disruptive link in the chain, not only for the pilot whose microphone was stuck but for others sharing the frequency--and the airspace--with that pilot.

BACKGROUND AND HISTORY: Perceiving a problem of significant proportions, the FAA air traffic control personnel have been working to reduce the safety-impacting potential for stuck microphones in pilot-controller communications. Surveys made periodically from 1968 through 1981 reflected major increases in the occurrences of disruptive stuck microphone situations in the ATC system. The number of incidents affecting aircraft separation and control doubled from 1968 to 1978 and tripled by 1981 over a similar survey period. Subsequent incident and operational error reports substantiate the continued problem.

Survey facts: 1730 incidents occurred in the system between September and February. Of these, 78% occurred in terminal areas. Other aircraft operations were affected in over 70% of the recorded incidents. 503 incidents were attributed to general aviation aircraft, 345 to air carrier, 52 to military, 20 to ground vehicles/other, and 810 caused by unknown sources. Results included a total of 391.4 hours of frequency blockage accumulated and numerous system operational errors occurred.

Microphones rarely become keyed by mechanical failure. Operator error is often the direct cause of unintentional continuous microphone keying. The problem becomes serious when inadvertent keying causes a complete and prolonged frequency blockage for several minutes in an environment where separation of aircraft is dependent upon timely communications to or from ATC.

SPECIFIC EXAMPLES OF PROBLEMS: Unsatisfactory Condition Report: (Air Carrier) had a stuck mike during peak rush period at O'Hare. Numerous aircraft were converging and descending for sequencing into the O'Hare terminal complex. (Air Carrier) mike remained stuck for approximately 5 minutes; this rendered all aircraft on frequency 135.9 incapable of receiving control guidance, causing an extremely dangerous situation and system delays to over 25 aircraft.

Daily Operations Report: Departure delays at Newark of between 19 to 23 minutes due to mike stuck on Newark frequency between 1323Z and 1333Z. Airports impacted included Newark (4 departures averaging 22 minutes each) Other adjacent facilities were also impacted. LaGuardia (45 departures averaging 20 minutes each), and other adjacent facilities.

Report of Near Midair Collision Report: A near midair collision occurred between (air carrier #1) and (air carrier #2) in vicinity of Livingston VORTAC in which a stuck microphone kept air crews from hearing separation instructions from Atlanta ARTCC. (Subsequent investigation of FAA Flight Standards personnel found air carrier #1 had a mike continuously keyed for over 5 minutes.)

Correspondence submitted to a leading industry organization clearly illustrates the importance of pilot vigilance in the area of monitoring radio equipment for potential problems:

"I would like to mention a radio problem that hit me recently... a stuck mike. Fortunately I was in a small airport, XYZ to be exact, and the pattern was active but nothing compared to ABC Municipal which was close by. It was probably 110 degrees in our cabin and I had just refueled and was anxious to get back up to cool air. I finished my run up and asked for permission to take off and suddenly realized I couldn't hear the tower, or anything for that matter, but my own voice. Then it hit me. I had a stuck mike. Normally this would not be a panic situation. All I needed to do was unplug the mike and go to an alternate. However in this case my mike switch was a small button behind the control wheel and when it was depressed there was nothing to grab hold of and pull out. In addition there were no external plugs to disconnect. In total frustration and confusion I told the tower of my problem and that I would return to the line. I was so involved with my situation I failed to realize the tower was helpless as long as my mike was stuck. Suddenly it released and I switched to a hand mike rather than risk further complications and called the tower for taxi clearance. The controller was less than happy with me, and let us cook for another five minutes before clearing us for takeoff. While sitting there like a lobster in a pot I had time to realize how serious a stuck mike would be in a major terminal. It wasn't until I was airborne that the thought hit me I could have turned the radios off, or better yet I could have switched to an unused channel. To complete my unhappy relationship with the poor tower operator, after take off I switched to ABC approach to enter the TCA, only during my dilemma I had switched to another transmitter that was still locked into the XYZ tower and I was continuing to interrupt his day with my repeated calls to approach control. I didn't have the guts to call back to apologize but instead headed home embarrassed but wiser."

POTENTIAL SOLUTIONS/PREFERRED TECHNIQUES: Increased pilot and controller attention to microphone keying and deliberate effort to preclude accidental keying caused by sitting on the microphone, holding key in, jamming keys, loose connections, and other inadvertent keying will help to remove unintentional microphone disorders, caused by human factors.

Electro-mechanical solution: Upon request from FAA and with outstanding help from users and equipment manufacturers, the radio Technical Commission for Aeronautics (RTCA) is nearing completion of a Minimum Operational Performance Standard for circuit/devices to terminate inadvertent continuous radio transmitter keying. In its most basic form, the device (if adopted by FAA) will automatically terminate a transmitter's output after a prescribed time (30 seconds) much as some general service transceivers now do for reasons of equipment protection (rather than operational considerations) after 2 or 3 minutes.

READBACK PROBLEMS

STATEMENT OF THE PROBLEM: The files of the NASA Aviation Safety Reporting System (ASRS) and the FAA are replete with reports of incidents caused by the failure of pilots to read back clearances issued by ATC. This fact corroborates a 1986 NASA report dealing with "hearback" problems. The report noted that "Perhaps no other essential activity in aircraft operations is as vulnerable to failure through human error and performance limitations as spoken communication."

BACKGROUND AND HISTORY: The definition of the term readback as noted in the Pilot/Controller Glossary as it applies to pilot action in response to the controller request is, "read my message back to me". Pilot inattention to proper readbacks is a major contribution to the magnitude of this problem. While there is no regulatory requirement that pilots read back clearances, the Airman's Information Manual (AIM) states, "Pilots of airborne aircraft should read back those parts of ATC clearances and instructions containing altitude assignments or vectors, as a means of mutual verification. The readback of the 'numbers' serves as a double check between pilots and controllers and reduces the kinds of communication errors that occur when a number is either 'misheard' or is 'incorrect'."

Airline flight operations manuals often impose more stringent requirements on air carrier pilots than those found in the AIM. The airlines' manuals upgrade the priority of reading back clearances from "should" to "must" status.

Pilots who do not consistently comply with the readback guidance in the AIM – whether they are general aviation or air carrier pilots – have poor radio discipline and affect controllers' ability to detect erroneous readbacks.

Pilots with a high degree of professionalism will listen carefully to a clearance and read it back in the sequence in which it was delivered. Making a deliberate effort to do so reinforces a positive habit pattern -- the pilot rarely fails to read back clearances.

Like pilots, controllers are creatures of habit. If controllers hear a readback after each clearance they deliver, they will be more alert for a readback following each future clearance they issue. If pilots do not consistently read back their clearances, controllers will not develop a high level of "hearback" discipline.

SPECIFIC EXAMPLES OF PROBLEMS: In the 1986 NASA report mentioned earlier, a significant number of ATC/cockpit communication failures were analyzed. In that sample, pilots heard some 53 percent of the numbers transmitted correctly by ATC. Moreover, flight deviations occurred in 14 percent of the cases in which pilots improperly acknowledged clearances with "Roger," "So long," "Okay," and other nonstandard replies.

POTENTIAL SOLUTIONS OR PREFERRED TECHNIQUES: The FAA holds controllers responsible for ensuring that pilot readbacks of clearances are correct. Pilots must help controllers fulfill that responsibility by providing them with consistent readbacks of all clearances in the sequence they were issued. Preferred techniques for pilot-issued readbacks of ATC clearances are described in detail in the AIM, Chapter 4, Section 4, Paragraph 265(b): ATC Clearance/Instruction Readback.

INITIAL RADIO CONTACT

STATEMENT OF THE PROBLEM: To contact most facilities within the ATC system, it is required that pilots use specific procedures. If these procedures are not followed, the result may be delayed or possibly failed communications.

BACKGROUND AND HISTORY: Radio message traffic has both differences and similarities to other forms of communications. Because the message is transmitted over airwaves and not across fixed lines (e.g. telephones), close attention must be paid to how our transmissions are addressed. Much like a letter that is improperly addressed, an improperly "addressed" radio transmission may not reach the intended party. However, the Post Office can often deliver a poorly addressed piece of mail, and likewise a poorly phrased radio transmission may reach its mark. Unfortunately, these dubious successes tend to lull us into complacency when making initial contacts.

SPECIFIC EXAMPLES OF PROBLEMS: Perhaps the best way to explain a bad radio message "address" would be to cite the following example of an improper initial contact:

> A VFR pilot at 10,000 feet calls watch on 122.0 MHZ for a
> weather update. The pilot used the following phraseology:
>
> "FLIGHT WATCH, CESSNA ONE TWO THREE FOUR KILO, ON 122.0, OVER."

The initial contact message did not include the name of the flight watch nor the nearest VOR. With this scant address and given the aircraft's altitude, several flight watch stations would have received the call and none of them could have determined a location for the aircraft. The correct phraseology must include the nearest VOR (giving the aircraft's position) and the name of the appropriate flight watch, if known.

SAMPLE PHRASEOLOGY: The AIM gives an excellent explanation and examples of proper phraseology for contact procedures. Paragraph 192 in Section 2 of Chapter 4 presents the appropriate "addressing" procedures for the following:

- o Initial contact
- o Initial contact when transmitting and receiving frequencies are different
- o Subsequent contacts and responses to call up from a ground facility
- o Acknowledge frequency changes
- o Compliance with frequency changes

POTENTIAL SOLUTIONS/PREFERRED TECHNIQUES: Considering the density of air traffic now and what it promises to be in the future, misdirected transmissions are becoming less tolerable to the system. By following the appropriate procedure when attempting initial radio contact with a ground facility, first-time contact and less frequency congestion will no doubt be the positive result. And for controllers, be sure to facilitate pilots by responding to initial callups -- whether correctly made or not -- with appropriate phraseology, which will undoubtedly prompt successful radio contact by the pilot throughout further transmissions.

STATEMENT OF
CAPTAIN THOMAS KREAMER
CHAIRMAN, AIR TRAFFIC CONTROL COMMITTEE
AIR LINE PILOTS ASSOCIATION
BEFORE THE
SUBCOMMITTEE ON AVIATION
COMMITTEE ON PUBLIC WORKS AND TRANSPORTATION
U.S. HOUSE OF REPRESENTATIVES
PILOT/AIR TRAFFIC CONTROLLER COMMUNICATIONS
MAY 24, 1990

Good morning, Mr. Chairman and members of the Subcommittee. I am Captain Tom Kreamer, Chairman of the Air Line Pilots Association's Air Traffic Control Committee. With me today is Mr. Ward Baker, the Senior Staff Engineer in our Engineering and Air Safety Department. ALPA represents the professional interests of over 42,000 pilots who fly for 50 airlines. We appreciate the opportunity to share with you our thoughts on an issue of paramount importance to aviation safety, that is, pilot controller communications.

Before addressing some specific areas of concern, I would like to provide a general view on the communications issue. As you know, the air traffic control system has always depended heavily upon mutual cooperation between pilots and controllers for successful operation. This concept will not change, even when data link between ATC and the cockpit is operational. The communications process we currently use to conduct operations, however, is the most fragile link in our safety chain. While the same procedures and terminology are used countless times in our system, the process is vulnerable and the potential for a breakdown is always present. The evolution of airline route structures into the hub-and-spoke concept has resulted in very intense communication and information processing demands being placed on both controllers and pilots during the peak activity times at these locations. This, coupled with normal traffic growth, has resulted in an unprecedented demand for increased capacity. To satisfy this need, a host of capacity enhancing procedures are now being evaluated. Virtually all of them result in a reduction of existing separation standards, and thus reduce the margin of safety at a time when controllers are required to work to the limit of their capacity. It is such times when the increased use of terminology and basic communications skills are compromised due to workload and situation dynamics. This type of environment has even extended itself to some en route sectors, where capacity is limited due to the sector controller being saturated. The bottom line, Mr. Chairman, is that we may be creating an operational environment that fosters human factor errors and, in turn, stretches that safety link I referred to a few moments ago to the breaking point.

The first specific item I would like to address is our implementation of the "Call to Action" booklet. This document is a product of the FAA Administrator's Air Traffic Procedures Advisory Committee, more commonly known as "ATPAC." Its development was a joint effort by all members of the committee, which incidentally, is composed of representatives from each of the aviation associations in the Washington, D.C., area as well as the three military services.

The primary purpose of the booklet was to create an awareness within the industry of a chronic problem and some actions that may help mitigate its effects. Actually, the booklet was one step in an industry overall communications awareness initiative that also included posters and commitments from the FAA and industry representatives to publicize the program and to widely distribute the booklet to their constituents.

I am happy to say that ALPA was a leader in this initiative. Let me tell you what we did. First, our printing department published all of the booklets and posters used for this entire program. They produced well over 200,000 copies of the publication and posters at a cost to our Association of almost $54,000. I do want to acknowledge contributions by the FAA and National Air Traffic Controllers Association that helped reduce this expense. An article titled "Trouble on the Party Line" was included in the November 1988 issue of the Air Line Pilot magazine. This article described in detail the communications awareness issue and reviewed the Call to Action booklet. I have included a copy of that article with our written statement. Copies of the booklet and posters were sent to virtually our entire air safety structure asking them to publicize the program to the maximum extent possible. I have also attached a copy of that letter to our statement. Finally, every member of our Association received a personal copy of the booklet as an attachment to a letter from Captain Hank Duffy, our President. In his letter, Captain Duffy clearly pointed out the importance of this program and asked pilots to keep the booklet in their flight kits for future reference.

I assure you, Mr. Chairman, ALPA more than fulfilled our commitment and responsibilities in supporting this program. We continue to do so today as we receive calls from the public for additional copies of the booklet. While we cannot comment on other organizations' support of the program, we were disturbed to hear from a number of controllers that they had never seen or received a copy of the booklet. Perhaps the FAA or NATCA could better comment on this point.

The second specific issue I would like to comment on is the FAA's use of human factors expertise in addressing the communications problems. Frankly, we are not aware of any previous significant projects along this line. We were encouraged, however, when the agency convened a meeting of industry representatives on March 6th and 7th for the purpose of examining human factors relating to pilot-controller communications errors. Several experts in this field attended that meeting and another is scheduled for May 30th and 31st. ALPA will certainly support this activity.

My final specific comment relates to problems air crews whose second language is English and the problems they encounter when operating in the United States. I believe I can best address this issue by referring to the discussions paper I have attached to our statement titled "Procedure and Language Problems Encountered by Foreign Crews Flying in U.S.A." This paper was presented at a June, 1984 meeting of the International Federation of Air LIne Pilots Associations (IFALPA) Accident Analysis Study Group. I can assure you that the comments in the paper are as germane today as they were then. If anything, the traffic increases and changes in procedures have exacerbated the problems. I am not sure its possible for our system to resolve all the issues presented in the IFALPA paper. What we must do, however, is look at each event individually and determine what can be done to minimize any misunderstanding. The Avianca accident is a classic example of a communications breakdown that can be fixed. Specifically, air transportation is international in scope and because of this, the identification of fuel problems must also be. A Pan American pilot advising Moscow Approach Control should be able to use the same terminology that has the same meaning to the controller as an Aeroflot pilot would use when advising New York controllers of a similar fuel problem. Pilots should not have to dig deeply into each country's Aeronautical Information Publications to see what the magic words are that alert controllers to a critical fuel issue. Such terminology should be part of the standard ICAO vocabulary and be accepted by all countries.

While the United States can attempt to make the pilots of other nations more aware of the procedures and terminology we use in dealing with low fuel situations, our ability to be successful in this attack is limited at best. What we need is an international solution that is developed and accepted by the International Civil Aviation Organization (ICAO).

Mr. Chairman, we ask that you use your influence in getting the FAA to submit to ICAO on a priority basis, a proposal that would address two points. They would be:

1. First, development of terminology that would be used by pilots on an international level to advise controllers that they are approaching a limited fuel condition. The U.S. phrase "minimum fuel" may or may not be suitable. Perhaps there is a more easily pronounced phrase for the international community and one that would not have any chance of not being incorrectly interpreted by controllers. In any event, we need a clear, concise term that indicates that when an aircraft reaches a destination, it cannot accept any delay.

2. Second, ICAO needs to emphasize to all pilots that when they are asked by controllers how much fuel they have remaining, they should respond in "minutes" until fuel exhaustion. As it stands now, when asked how much fuel is available, pilots frequently respond with times to their reserve fuel rather than fuel exhaustion. Because of the wide variety of fuel reserves required by different countries, companies and pilots, this is not a good response and does not provide controllers the information they need to make operational

decisions. Therefore, a common, internationally accepted response is needed to insure both sides are working with a common understanding.

In summary, Mr. Chairman, pilot-controller communications is still the most vulnerable link in our national airspace system and perhaps even on an international basis. We do need to continue our research into problem areas and insure we correct known problems as soon as they become evident. This concludes my remarks and I would be happy to answer any questions.

SCHEDULE WITH SAFETY

LISTEN— READ BACK— COMPLY

■ By Capt. Tom Kreamer

Pilot/controller communication does not end when the microphone button is released.

"Thunder Air two twenty, slow to two seventy, turn right heading zero five zero, and descend and maintain one three thousand," calls the controller.

"O.K.," comes the reply over the controller's headset.

But who transmitted the reply—Thunder Air 411, Pride Air 917, USAir 707, Flying Tiger 321?

Three minutes pass and the controller hears "Dart Air four twenty two. Just had a near miss by 200 feet with a 747 at our altitude."

The controller, totally taken off guard, requests Dart Air 422's altitude.

"Just leveling one three thousand, Center."

"Negative, Dart Air. Climb *immediately* and maintain one five thousand; the previous clearance was for Thunder Air two twenty. Let's listen up, gentlemen," comes the response from the center controller.

An exaggeration? Not at all. It has happened innumerable times. It is happening today, and I assure you, it will happen in the future. We can only hope that the poor communications techniques will not cause a disaster.

What would have avoided this near midair collision? A simple "Roger, Dart Air four twenty two" read-back would have told the controller that the wrong aircraft had copied the clearance.

Somewhere the communications loop broke down, but more than one problem appears in the breakdown. First, the controller issued entirely too many instructions in one clearance, and a multiple clearance tends to create problems. Secondly, the controller should have warned the pilots of several aircraft having similar call signs. And the Thunder Air 220 pilot should have read back the clearance. Further, the unidentified "O.K." could have come from anyone, and sure enough, it didn't come from Thunder Air 220. Another unidentified party is "just leveling one three thousand," and finally some Dart Air aircraft on the frequency is instructed to climb to one five thousand. The potential for other troubles is high.

Proper communication

Each of us should take the time not only to listen to the air traffic control (ATC) communications between other aircraft and the air traffic controller, but also to try to understand the replies.

Those of us involved in ALPA's air safety structure are seeing a great increase in FAA filings of alleged violations. Too many result from poor communication techniques used by pilots and controllers.

In doing research for this article, I read through the glossary of both the Federal Aviation Administration *Air Traffic Control Handbook* and the *Airman's Information Manual* (*AIM*). I found the following key words and their meanings used in our everyday radio communications:

- "Affirmative"—Yes
- "Negative"—No
- "Negative contact"—Used by a pilot to inform ATC that: (1) previously issued traffic is not in sight (it may be followed by the pilot's request for the controller to provide assistance in avoiding the traffic); or (2) the pilot was unable to contact ATC on a particular frequency.
- "Roger"—"I have received all of your last transmission." It should not be used to answer a question requiring a yes or a no. (See affirmative/negative.)
- "Wilco"—"I have received your message, understand it, and will comply with it."

I searched everywhere I could think of and never found listed as proper phraseology, the use of such words as "Okey dokey," "Yep," "O.K." "10-4," "See ya," or "We'll do all that."

What's the rush?

While the words above apply mostly to pilots, the pilots are complaining about receiving clearances with the words "expedite," "best rate," and "immediately."

When an air traffic controller tells a pilot to expedite, the pilot senses an urgency that may just border on an emergency—perhaps conflicting traffic in the immediate vicinity.

As for "best rate," the expression has no definition—it can mean anything from a climb or descent that is comfortable to the extreme of one that causes the passengers to watch their ice cubes leave their refreshment glasses and float majes-

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Tom Kreamer, a DC-9 captain for USAir, is the vice-chairman for operations of ALPA's Air Traffic Control Committee and a member of ALPA's Human Performance Committee and Accident Investigation Board.

tically by in front of their eyes.

Sometimes when there is less than 1,000 feet to go in reaching an assigned altitude, I hear a voice coming through my headset requesting "Best rate to _____ feet, please."

In discussions I've had with controllers, I've found few who realize that the last 1,000 feet of climb or descent should be accomplished at a rate of 500 feet per minute. Though it is not in their handbook, it is in the *AIM*. (New-generation flight and performance management systems seem to have a difficult time with this one also.)

And finally, "Cleared for *immediate* takeoff." One must wonder, why the rush? If traffic is so close, we might want to wait. What happens during an "immediate takeoff" if we abort? Obviously this places another strain on the ATC system, because now the aircraft that was two or three miles out on final must go around and remain in the system.

"Immediately" is an important, sometimes critical word—when used in the proper context. "Expedite" and "immediately," in the controllers' own glossary, stress that the flight crew should comply to avoid an imminent situation. "Best rate"—who knows?

A revealing study

In 1983, the National Aeronautics and Space Administration issued a report titled "Addressee Errors in ATC Communications: The Call Sign Problem," prepared by Capt. William P. Monan of Battelle Columbus Laboratories. Previously the regional director of flight operations for an international airline, Monan studied deidentified Aviation Safety Reporting System (ASRS) reports to prepare his study.

Users of the aviation system submit a great deal of worthwhile information to ASRS. Some of the comments about and reasons for the communication errors may help us all, pilots and controllers, to improve our communicating skills.

Too many alleged FAA violations result from poor communication techniques used by pilots and controllers.

A few of the miscommunicated ideas, as well as some of the information given by crews, general aviation pilots, and controllers, follow:

- The deliberately over-abbreviated call sign—For various reasons, from workload problems to complacency, both controllers and pilots either made or were reported to have made intentionally shortened aircraft call signs during call-ups and in acknowledgments.

A pilot calling a center or reading back a clearance must use the full call sign. Using only the flight number or only the company name serves no purpose, except to degrade safety. Too often more than one aircraft have similar sounding flight numbers, and generally more than one company flight is on the frequency.

This is a problem not only for pilots but also for controllers. Many times a controller issues a clearance using just a flight number, only to receive a read-back from a pilot for whom the clearance was not intended.

- Errors related to frequency congestion—The *AIM* clearly points out that we must be certain that aircraft identification is complete before taking any action on an ATC clearance. It also reminds us that all read-backs and acknowledgments should be preceded by aircraft identification. As the *AIM* says, "The requirement becomes more important as frequency congestion increases."

Errors related to frequency congestion fall into three categories: anticipation, nonstop ATC transmissions, and clearance amendment problems.

- Anticipation—How many times have you been cleared into position and, as the controller transmitted a clearance, started to release the brakes and advance the throttles, only to hear the clearance issued to another aircraft on a crossing or parallel runway? This same type of anticipation occurs in other areas, such as awaiting a clearance for a previous request for a higher or a lower altitude.

Remember: *Listen—read back—comply*—don't take an action on your own.

- Nonstop ATC transmissions—A controller's nonstop transmission should make you realize that that controller is involved in a heavy workload situation and alert you to exercise caution in listening and responding to clearances.

If an overload situation is the problem, however, we must address FAA to correct that problem. We must not excuse the controller for the nonstop transmission, but neither can we excuse the crew who "thought" they received a clearance, were "unable to break in" for a read-back, and simply complied with the clearance—only to discover that the clearance was not for them.

- Clearance amendment problems, or "I can be a better controller"—Can you remember the times you were racked with frustration on being cleared 2,000, 3,000, 5,000 feet at a time, the infamous step climb or descent, only to have to stay at the assigned altitude for an extended period of time? Or just as you arrived at the cleared altitude and began to retard the throttles, received another altitude clearance? Or you received so much vectoring you were sure the controller had no idea where your destination was?

Frustrating? You bet! Can you do it better? Can you see all of the traffic the controller is working? Of course not! But some pilots—private, corporate, and air carrier—believe the controller is giving them a raw deal.

One unfortunate problem that

arises when some people get itchy for a clearance is that they initiate an argument over the radio—questioning the controller, asking for traffic, etc. Needless to say, this adds only tension and confusion to the system. There is no excuse for arguing over the radio.

Operating an aircraft in today's ATC system is considerably different from just a few years ago. With traffic at many terminals more than double what it was a short time ago, we are experiencing over-saturated frequencies and, in some cases, almost nonstop radio transmissions. These things, coupled with the system's having some controllers still in on-the-job training and some controllers working many hours of overtime, add an "edge" to a system that once had an almost relaxed atmosphere.

Recent report on hear-backs

In March 1986, NASA published "Human Factors in Aviation Operations: The Hear-back Problem," written by Monan, who again spent a great deal of time studying deidentified ASRS reports.

Monan opens his remarks by saying: "Every week during a two-and-a-half-year period, three to four 'Where are you going?!' hazardous occurrence reports have been submitted to the Aviation Safety Reporting System: . . . deviations from assigned altitudes, unauthorized taxi crossings of active runways, nonadherence to DME [distance measuring equipment] crossing altitudes, turns to incorrect vector headings, and various flights over the wrong jet or Victor airways. In all, 417 such errant actions were attributed by ATC controllers and airman reporters to misunderstood, misinterpreted, mistransmitted, or unheard numbers in ATC-to-cockpit communications exchanges. Of the 417 incidents reported, 85 reports were submitted by ATC controllers and 332 by crew members."

What is greatly disturbing is that many of these actions precipitated near midair collisions, go-arounds, traffic conflicts, aborted takeoffs, and, in some cases, certificate action by FAA. In other cases, the immunity granted by the use of the ASRS program aided in the pilots' avoiding certificate actions and ensured the reporting of these problems so they could be analyzed.

Of greater importance than the certificate action, which only the ASRS immunity prevented, is the absolute potential for disaster.

Monan points out that "perhaps no other essential activity in aircraft operations is as vulnerable to failure through human error and performance limitations as spoken communication. Decades of operational experience in aviation developed the read-back/hear-back confirmation procedure. When ATC messages pass unmonitored and unverified through the communications loops, the conflict alert frequently signals the occurrence of a misheard, unheard, or mishandled communication."

Enter the data link! ALPA, FAA, and the aviation industry have spent and will spend considerable time and resources developing a system enabling you to actually verify your clearance on a cathode ray tube display in the cockpit. Although this capability is still in the future, work is progressing steadily.

Subtle errors

In a great many ASRS reports, Monan notes, even though the controller received a read-back, it was incorrect and the controller did not catch the mistake—the conflict alert system did.

Many other reports, however, indicated that the nonflying pilot "assumed" the flying pilot had heard a new clearance or "thought" the flying pilot would change the new altitude in the altitude alert equipment. Assumptions, of course, have no place in the cockpit and almost invariably lead to serious conflict.

We must all realize that communication does not end when the microphone button is released. Crew coordination must be followed through to ensure that the entire crew is aware of a clearance.

Improving the system

For passenger and crew safety, we pilots must set the standard in using proper procedures.

A pilot who notices deficiencies in the system—poor communication techniques; argumentative controllers; extended step climbs, descents, or vectoring; or any other problem that degrades the overall ATC system—should call the ALPA Air Safety Hotline at 800-424-2470 and outline the problem encountered. In addition, the pilot should complete and mail a NASA ASRS form. The ASRS form will assist NASA and other responsible parties to pinpoint trouble areas within the system.

Remember, a pilot may complete and mail these forms as often as desired. Immunity is invoked only when FAA files a violation against the pilots.

Attaining the highest level of safety possible in day-to-day flight operations instead of degrading it is every pilot's goal.

To help achieve this goal, a pilot should:

- Always use complete call signs.
- Read back clearances, including numbers such as headings and altitudes, which if misread could cause serious incidents.
- Listen and make sure the clearance acknowledged is the clearance given for that pilot.
- If unsure of a clearance, ask the controller to "say again."
- Be especially cautious when a controller is involved with nonstop transmissions and/or multiple clearances.
- Not argue with the controller (we are in the system together).
- Not make unnecessary requests from ATC when the controllers are busy.
- Consider using headsets.
- *Listen—read back—comply.* ✈

Sincerest appreciation and gratitude to the following aviation community groups for their support and contributions to this vital effort:

AIR LINE PILOTS ASSOCIATION
AIR TRAFFIC CONTROL ASSOCIATION
AIRCRAFT OWNERS & PILOTS ASSOCIATION
AOPA AIR SAFETY FOUNDATION
AIR TRANSPORT ASSOCIATION
DENRO
FEDERAL AVIATION ADMINISTRATION
GENERAL AVIATION MANUFACTURERS ASSOCIATION
NATIONAL ASSOCIATION OF AIR TRAFFIC SPECIALISTS
NATIONAL AIR TRAFFIC CONTROLLERS ASSOCIATION
NATIONAL BUSINESS AIRCRAFT ASSOCIATION

Special thanks to Captain Tom Kreamer, Ms. Amy Lynn Kauffman, Mr. Paul Strybing and Mr. Willie Card for extensive coordination and unwavering dedication beyond the call of duty to the success of the communications awareness program.

Publishing Services: Mike Moore, Desktop Publishing Service
Air Line Pilots Association Print Shop

PILOT/CONTROLLER COMMUNICATIONS AWARENESS

For additional information contact the FAA Air Traffic Service or ATCA.

AIR LINE PILOTS ASSOCIATION

535 HERNDON PARKWAY ☐ P.O. BOX 1169 ☐ HERNDON, VIRGINIA 22070 ☐ (703) 689-2270

November 16, 1988

CENTRAL AIR SAFETY CHAIRMEN
LOCAL AIR SAFETY CHAIRMEN
AREA SAFETY COORDINATORS
AREA ATC COORDINATORS
AIR TRAFFIC CONTROL COMMITTEE

Dear Members:

Enclosed is an information packet containing booklets and posters describing a joint FAA/industry partnership to improve pilot/controller communications.

For a considerable amount of time, FAA and industry, including ALPA, have been concerned about effective communications between the providers and users of the air traffic control system. Because of this concern, a working group was formed with the goal of promoting industry awareness to the issue of proper communications.

The main thrust of this program is the enclosed booklet, "Aviation Industry, A Call to Action," which every ALPA member will be receiving, and the enclosed posters, drawing attention to proper communications.

FAA contributed a great deal of time and effort assisting in the preparation of this program, as well as printing the "Call to Action" booklet and the design and printing of the enclosed posters.

We would appreciate your support of this program by keeping the members aware of the importance of proper communications procedures. This would also be a good time to consider approaching your individual training departments and having them include proper communications procedures reminders during current training.

In addition, we have printed a sufficient quantity of posters to be placed in all member airline operations and crew rooms. Since there are four different posters, you should consider displaying each poster for a three-to-four week time period.

November 16, 1988
Page Two

Thank you for your support and participation in this program.

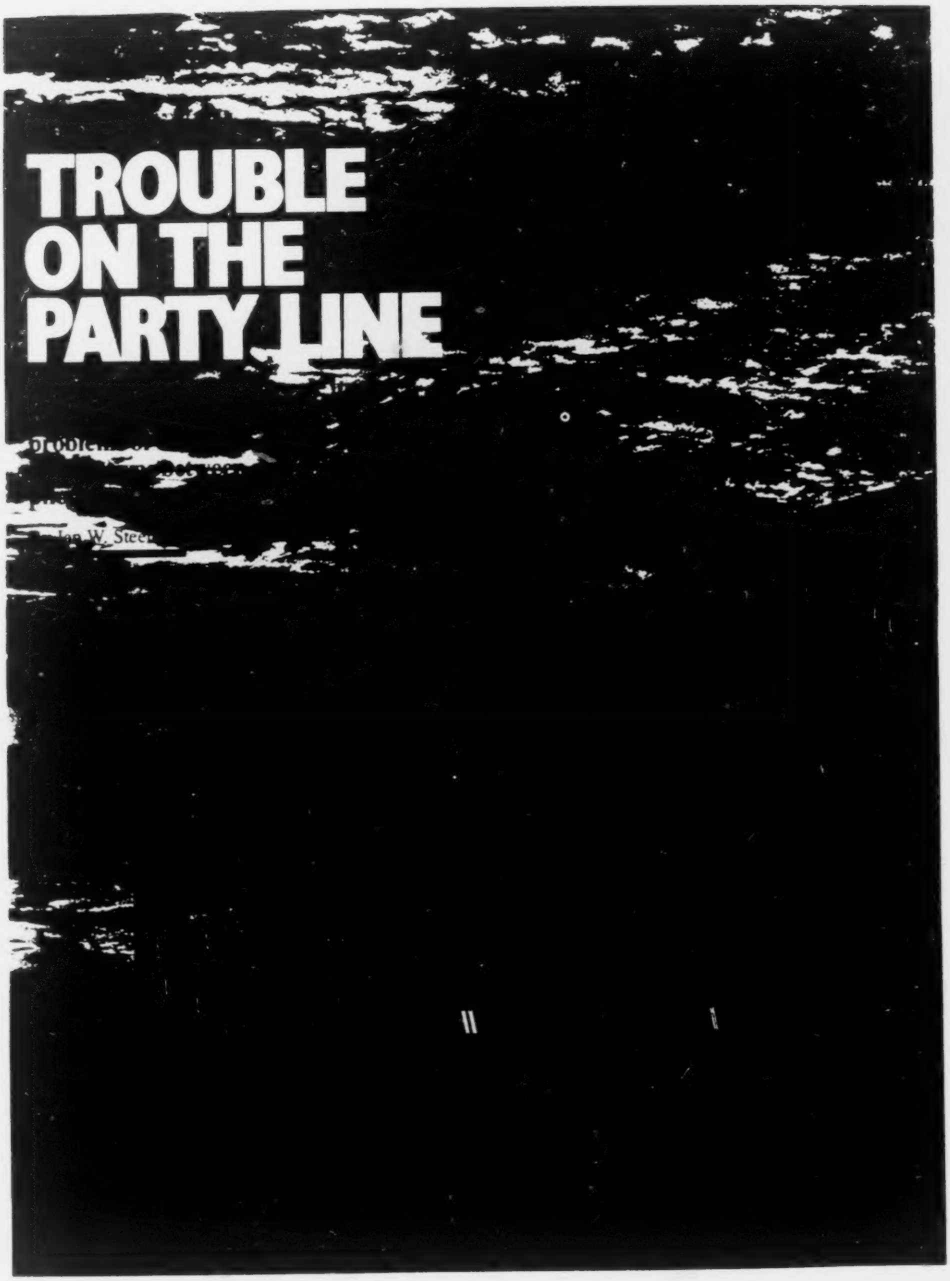
Sincerely,

Tom Kreamer

Captain Thomas J. Kreamer
Vice Chairman, Operations
Air Traffic Control Committee

TJK:jeg
enclosures

cc: L. McNair
T. Selken



TROUBLE ON THE PARTY LINE

problem

Jon W. Stee

"FAA considers communications problems between pilots and controllers high on its priority list and fully supports this joint FAA/industry and pilot/controller communications awareness initiative."
—Allan McArtor, FAA Administrator

Some aviation safety problems affect only certain pilots; others affect every pilot. One problem that affects every pilot who flies an aircraft equipped with radios—including every pilot of every airliner, large or small—is the daily breakdown in verbal communications. Actually, it's not a single problem, it's a whole group of problems. And they're getting worse.

But ALPA and a number of other concerned aviation groups have joined forces with the Federal Aviation Administration, the U.S. Air Force, and the National Aeronautics and Space Administration's Ames Research Center to meet this growing family of problems head-on with a massive education campaign.

Earlier this year, ALPA and other members of the Air Traffic Procedures Advisory Committee formed a working group to seek ways to improve ATC communications between controllers and flight crews to reduce controller operational errors and pilot deviations. ATPAC is a standing group composed of air carrier, controller, general aviation, military, and pilot representatives to review ATC procedures and practices. FAA selected the 15 member organizations in 1975 as most representative of the overall viewpoint of all aviation and airspace users. Capt. Jim Woodhead (USAir), a member of ALPA's Air Traffic Control (ATC) Committee, currently serves as chairman of ATPAC.

In April 1988, ATPAC, reflecting the growing industry concern about the increasing seriousness of communications problems involving pilots and controllers, promulgated a recommendation that FAA develop a plan to promote pilot and controller awareness in this vital area of interactive communications. The agency was immediately receptive, and ATPAC put together a working group to tackle these issues.

Members of the ATPAC working group on communications represent ALPA, the Air Traffic Control Association, the Aircraft Owners and Pilots Association, the AOPA Air Safety Foundation, the Air Transport Association, Denro (a private consulting firm), the General Aviation Manufacturers Association, the National Association of Airways Traffic Specialists, the National Air Traffic Controllers Association, the National Business Aircraft Association, NASA Ames Research Center, the U.S. Air Force, and FAA.

The working group met several times during 1988 to develop a comprehensive plan to promote communications awareness within the aviation community. Their goals are to "foster improved communications between pilots and controllers as a means of reducing system operations problems, increasing user professionalism, and enhancing system safety."

Acknowledging that this is an ambitious objective, the working group nonetheless feels it can be achieved through the partnership of its member organizations and their individual constituents. The working group has launched an extensive, nationwide information campaign, in cooperation with FAA's "Back to Basics" program, to continue from October through December 1988.

The campaign includes special events, publications, and extensive promotion through the news media and other information outlets to publicize these issues, with November slated as the month for greatest activity.

The program coordinators have said they will use posters, handbooks, magazine articles, press releases, seminars, participation in industry conventions, and insertion of these issues into training programs "to capture a large audience of both controllers and pilots."

The program has the enthusiastic endorsement of FAA Administrator Allan McArtor, who said, "FAA considers communications problems between pilots and controllers high on its priority list and fully supports this joint FAA/industry and pilot/controller communications awareness initiative. I urge each system user to respond to this 'Call to Action' by making a commitment, as FAA has done, to increase system efficiency and safety through improved communications."

McArtor noted that "FAA, the Department of Defense, and leading organizations from the aviation community have worked together to develop an integrated program that is designed to improve safety and professionalism throughout the ATC system. The purpose of this program is to combine ongoing activities among FAA and ATC with focus on pilot/controller communications."

A highlight of this intensive campaign is a booklet, titled *Call to Action—A Joint FAA/Industry Partnership to Improve Pilot/Controller Communications*, to be distributed widely throughout the aviation community.

Capt. Tom Kreamer (USAir), vice-chairman of operations of ALPA's ATC Committee and the association's representative to the ATPAC working group on pilot/controller communications, reports that ALPA has had a major role in preparing the booklet.

"We've provided the services of ALPA's Printing and Mailing Department, at cost, to print the booklet," says Kreamer. "We're printing 240,000 cop-

According to NASA's Aviation Safety Reporting System, approximately 80 percent of the ASRS reports filed by pilots and controllers during the past three years refer to ineffective spoken communications.

ies. FAA has already ordered 30,000 for its own people, and we plan to send a copy to every ALPA member in the near future.

"ALPA also designed, printed, and is distributing a series of posters that draw attention to problems with pilot/controller communications."

The booklet includes sections on each of the 12 specific areas of concern to the joint FAA/industry working group:

- similar-sounding alphanumerics,
- blocked/simultaneous transmissions,
- headsets versus speakers,
- enunciation,
- radio discipline,
- pilot "readback" problems,
- controller "hearback" problems,
- controller intercoordination communications problems,
- stuck microphones,
- intra-cockpit communications,
- phraseology, and
- procedures for initial radio contact

Each section includes a short statement of the problem, its background and history, specific examples of the problem, and potential solutions and preferred techniques.

Even the sections that might not seem directly applicable to pilots contain some gems. For example, in the section "Controller Hearback Problems," the booklet points out that "many center controllers now work alone and are not monitoring the frequencies exclusively." In the past, enroute centers commonly used one controller per sector to control traffic directly, a second controller for inter- and intra-facility coordination, and a third to process paperwork. Now, says the booklet, "there is one controller doing all three jobs simultaneously. *In some centers, this situation exists 75 percent of the time* [emphasis added]."

What does this mean to flight crews? Advises the booklet, "Pilots should be aware of this in the event that an immediate reply—or *no* reply—from a controller is forthcoming, especially after the pilot reads back a lengthy clearance. In this case, pilots should question the controller to make sure he or she heard your readback. He or she may have been called away to answer a land line as you were speaking."

The booklet also points out that "of the numerous communications problems evident throughout the ATC system, the most common and troublesome is the improper use of established and recommended phraseology by pilots and controllers" alike.

Here's another: "Surveys made periodically from 1968 through 1981 reflected major increases in the occurrences of disruptive stuck microphone situations in the ATC system. The number of incidents affecting aircraft separation and control doubled from 1968 to 1978 and tripled by 1981 over a similar survey period. Subsequent incident and operational error reports substantiate the continued problem."

Flight crews may be well aware that "the problem becomes serious when inadvertent keying causes a complete and prolonged frequency blockage for several minutes in an environment where separation of aircraft is dependent upon timely communications to or from ATC." But did you know that "microphones rarely become keyed by mechanical failure"? Says the booklet, "Operator error is often the direct cause of unintentional continuous microphone keying."

According to NASA's Aviation Safety Reporting System, approximately 80 percent of the ASRS reports filed by pilots and controllers during the past three years refer to ineffective spoken communications. And as the capacity of the U.S. air transportation system is stretched to ever greater limits, the risk to aviation safety and the loss of efficiency in that system due to verbal communications problems only increases.

But the government/industry working group stresses that it "does not profess to have the solutions to these problems." Instead, the working group's initiative aims to "focus the attentions of each and every pilot and controller on the topic of communications as a means of removing the breakdown potential at the source, in lieu of resolving the issue after it has become a problem."

The booklet that ALPA helped write and print stresses that "basic common sense and utilization of existing procedures and techniques will produce immediate, measurable results by eliminating or reducing the risk of communications-loop breakdown." On the other hand, the booklet advises, "Intensive studies, complicated resolutions, and technological changes will in no way provide any measurable benefits unless we, as a collective industry, stand by our commitment to professionalism and incorporate the elementary lessons of basic communications techniques as part of our daily performance."

That's why the joint government-industry working group says that "this Call to Action is exactly that—an appeal to each and every member of the aviation community to respond to the need for improved communications as a means of enhancing both safety and performance" in the U.S. aviation system.

Reference: AIG/4/9 DdJ/JB

L85c19
8th May 1984

To: Members, AA Study Group
cc: Chairman, ATS Study Group
RVP NAA

AA Discussion Paper

IFALPA Accident Analysis Study Group Meeting
Paris, 5th-7th June 1984

Agenda Item 2.2 : Difficult ATS Environments

(submitted by Captain D. De Judicibus - ANPAC)

PROCEDURE AND LANGUAGE PROBLEMS ENCOUNTERED BY FOREIGN CREWS FLYING IN U.S.A.

Most of the foreign flights arriving in the USA are long distance ones and only a minority of them originate in an English speaking country. The crews are obviously tired and sometimes fatigued and will easily be overloaded and overstressed if they should encounter too different an ATC environment than usual or one lacking understanding of foreign crews' language problems; matters could become marginal in concomitance with adverse flight conditions.

All the pilots flying outside the USA (American pilots included) comply with ICAO ATC and Communications Standards that are accepted and applied (with certain differences in quality, of course) the world over. But when the foreign crews arrive in the USA they are basically confronted with a non-ICAO ATC environment.

Most of the foreign flights land in the USA at large congested airports the traffic areas of which, besides the strictly commercial airplanes, do often also accept intermixed executive and third level traffic.

ICAO ATS and Communications Standards give a non-English/American born pilot the possibility of comprehending traffic information and clearances on the basis of a limited repetitive phraseology. They utilise a small number of words and common sentences that are always strictly related to a specific situation or flight condition, thus helping an understanding even when the pronounciation of the pilot or the controller is not the best of Oxford. As a matter of fact, very seldom in the whole world are comprehension problems encountered by non-English/American pilots, except in the USA.

Nobody can deny that the ATC service in complex and congested Terminal Areas such as those of the big American airports is conducted in anything but a very efficient and professional way. However, from the foreign crews' standpoint, too often too many controllers unconsciously build up difficult and potentially dangerous conditions for the following reasons:

- clearances and information are given in non-ICAO form using language that is certainly English but that widely exceeds the limited ICAO vocabulary;

- most controllers, for time-saving reasons, use too many machine-gun clearances and traffic information, concentrating too much in only one transmission. This occurs particularly during final approach when no read-back confirmation is actually possible or requested;

- the language that controllers use is frequently colloquial slang or American-English with a strong regional cadence that makes understanding very difficult or impossible, even to some British pilots;

- abnormal or unusual traffic conditions on the ground or in flight are sometimes handled in a kind of familiar colloquialism that is almost unintelligible to foreign crews;

- meteorological reports do not use international format or measuring units.

Interviewed pilots have reported a slight worsening of the situation after the President Reagan-controllers clash but on the other hand have also confirmed the presence amongst American controllers of many who make an effort to use a clearer and slower speech when addressing foreign crews.

The above-mentioned inconveniences are producing the following effects:

- only one of the crew members understands the meaning of the communication, compelling him to "translate" or clarify it to the others. If the one who doesn't understand happens to be the Captain, the result is obviously the request of "saying again";

- no one understands the message in full. The obvious consequence is the request of "saying again" but it often happens that, after some discussion in the cockpit, the meaning of the information is agreed on the basis of the flight situation and of the few words that passed through. This is how an aggressive and apparently strict time-saving ATC environment misleads those pilots who are afraid of interfering with the smooth progress of the control action or of showing language deficiencies.

In both cases a supposedly time-saving concentration of communications in fast, unpolished language results in more waste of time. What is worse, though, there is no certainty of message comprehension, a certain degree of crew overloading and some frustration for the crew members who showed poor language comprehension. Further dangerous effects can be the interruption of the crew loop, prolonged distraction, wrong application of clearances, misuse of the traffic information, a wrong decision process or temporary mishandling of the machine.

The ultimate solution to such a problem would be for the USA aviation "to go fully ICAO" just like the nation is "going metric". However, one must not forget that an enormous part of world aviation traffic is flown within the USA and it would be extremely difficult and, in some respects also unfair, to ask for radical changes to established customs and habits simply because of the difficulties experienced by foreign pilots.

It is more realistic to make US ATC Authorities aware of the problem and of its dangerous implications. A good preventative measure would be the indoctrination of Air Traffic Controllers in the areas where foreign long-distance flights terminate, for the purpose of obtaining:

- communications in a simpler basic English, as close as possible to the ICAO language;
- fewer clearances and information given in each transmission;
- patient acceptance of read-backs to which ICAO pilots are accustomed for safety reasons;
- slower, clearer and slang-free language, especially in necessarily long communications or when issuing clearances.

Even though ocean-faring pilots are obliged to learn the best possible English, all should bear in mind that it is the ATC at the service of the crews and not vice versa and that to address readable radio messages is in everybody's interest. It is fortunate that very few incidents and possibly no accidents at all have occurred in recent years from causal-factors arising from the above-indicated situations. However, this is not a good enough reason for leaving some questionable aspects of the USA ATS environment untouched; the facts are simply saying that we are still in time to avoid possible future trouble.

Danilo De Judicibus
ANPAC,
viale dell"Esperanto
00144 Roma, Italy.

WRITTEN STATEMENT
OF
Cheryle Leon
President, Association of Professional
Flight Attendants
1004 W. Euless Blvd.
Euless, Texas
Before the Subcommittee on Aviation, House
Public Works and Transportation Committee

May 24, 1990

Mr. Chairman and Members of the Committee: I am Cheryle Leon, President of the Association of Professional Flight Attendants. I greatly appreciate the opportunity to testify before you today on the increasingly critical safety issue of flight communications both between aircraft and controllers and between crew on board aircraft.

Alone among the major carriers, American is now planning to staff foreign national flight attendants on many flights between Latin America and U.S. gateway cities and from foreign point to foreign point. The airline will not require that these foreign national flight attendants be bilingual in English and there is no current federal requirement that flight attendants be proficient in English. The inability of foreign flight attendants to speak fluent English is a serious threat to passenger safety for two reasons. First, all flight attendants are responsible for responding to a variety of inflight safety and security emergencies which require quick crystal clear communications in a common language between flights attendants and cockpit crew. Second, the stressful and hurried nature of

emergencies makes it difficult for even native English speakers to communicate effectively. APFA urges Congress and the Federal Aviation Administration to investigate this matter and promptly adopt legislation and regulations which would require that all flight attendants on U.S. flag carriers be able to speak English fluently as a condition of flying.

The Department of Transportation has recently approved a transfer of Eastern Airlines' Latin American routes to American Airlines. This transaction is presently scheduled to take place on July 1st. On these Latin American routes, American plans to staff all inter-American Latin routes exclusively with foreign nationals. In addition, American intends to employ foreign nationals on many flights originating in Latin America, destined for U.S. gateway cities and expects to use foreign national flight attendants from U.S. gateway cities to foreign destinations, and from foreign point to foreign point. This means an increased number of non native English speakers would be flying into airports in the United States and serving as crew on flights in U.S. airspace. This is not an issue which ends in Latin America. American Airlines, a strong and prosperous airline, has plans to expand its operations extensively in Asia and Eastern Europe and is likely to seek to hire foreign national flight attendants on these routes as well.

Presently, no other carrier, including, Eastern, follows a practice of hiring an unlimited number of foreign nationals on U.S. airlines. Even Eastern limits the number of foreign nationals and uses foreign nationals almost exclusively on flights which do not touch the United States.

The foreign flight attendants that American hires will be, as are all flight attendants, responsible for a number of key safety functions aboard aircraft. Flight attendants are responsible for evacuating aircraft during post-crash fires, detecting and extinguishing in-flight fires, protecting passengers in explosive decompressions and treating passengers with in-flight medical emergencies. In an era of heightened concern over terrorist activities on airlines, flight attendants are charged with monitoring the aircraft for bombs and managing the cabin during a hijacking. If a plane is required to have an over-water evacuation it is the flight attendant's responsibility to supervise evacuation from the airplane by water rafts. Each of these functions requires strong communication between not only between flight attendants and passengers, but also between flight attendants and the cockpit crew.

One of my own experiences as a senior flight attendant illustrates how critical communication between cockpit and flight attendant crew can be in the case of an emergency. Several years ago, while serving as a senior flight attendant on a flight from Chicago to Los Angeles, one of the passengers became unruly in the course of the flight. This individual had smuggled a large quantity of alcohol onto the aircraft and was mentally unstable. A flight attendant requested assistance from the cockpit crew in controlling this passenger. The flight engineer responded to her request and ran headlong into the passenger's fist. The flight engineer was knocked unconscious and suffered a broken collar-bone. FAA regulations and company policy provide very strict instructions for what steps must be taken when a cockpit crew member is incapacitated. It was the flight attendant's responsibility to communicate to the cockpit crew accurate information to allow them to ascertain how much longer the aircraft is permitted to fly, where it can land, and what assistance the incapacitated crew member requires. In the heat of the moment it was imperative that I was able to communicate with the pilots.

These types of in-flight emergencies, while not routine, are certainly not extraordinary. On each flight there are times when flight attendants must be able to communicate with all other crew members in a common language. For example, medical emergencies are regular occurrences which require strong communications. American Airlines alone reports at least one medical emergency a day. These medical emergencies include both passengers and crew. American reported 21 instances of incapacitation of a crew member in the last year alone.

If a passenger or flight attendant has a medical emergency on board, the flight attendant must assess the person's condition and communicate it quickly and clearly with the Captain so that a decision about whether to make an unscheduled or emergency landing can be made. Over-water flights reach a point of no return in which it is quicker to proceed than return from point of origin. On these flights in particular, quick, clear communication is essential.

Clear communication is critical when a flight attendant observes a serious problem while the aircraft is on take-off roll. Generally, flight attendants are aware that this is a crucial time of flight and avoid contact with the cockpit until the aircraft is airborne except in an emergency. Communication with the cockpit at such a time is difficult at best because of the extremely high noise level due to full engine thrust for take-off and the relatively poor quality of aircraft interphones. Nevertheless, if a flight attendant observes an emergency such as an engine on fire, the flight attendant must immediately contact the cockpit giving clear and succinct information. Precious seconds are lost if the pilot must ask for the information to be repeated -- precious seconds that could determine whether the pilot still has enough runway to stop the aircraft or must lift the aircraft off the runway.

In the event of an inflight fire, flight attendants must communicate quickly with the cockpit crew. For example, some wide-bodied aircraft have ducts to vent ovens located directly inside the fuselage. A fire within one of these ducts requires prompt notification to the cockpit--otherwise a fire could burn through the fuselage in a matter of seconds.

There are other situations that could be complicated by having foreign national flight attendants. In the event of an evacuation, a foreign national flight attendant may revert to his or her tongue thus giving evacuation instructions strictly in a foreign language. In a smoke filled cabin or a night emergency landing, these directions could mean the difference between life and death for passengers.

Sometimes the nature of the emergency, rather than just the stress of the emergency, will make communication more difficult. Several years ago fiberglass was released into the airconditioning system of an American Chicago to San Francisco flight. The fiberglass dusted the entire aircraft and caused crew and passengers alike to experience severe coughing and painful breathing: the symptoms themselves impaired in-flight communication.

Each of these situations present emergencies which must be managed quickly, professionally and under a high degree of stress. The life and death context of these emergencies underscores the importance that each flight attendant be able to communicate with the cockpit crew.

As these illustrations make clear, succinct, effective communication is always a concern of all of those in the aviation community and the flying public. Problems in the crew communication takes an additional dimension when foreign national flight attendants are brought on board. Many, probably nearly all, of foreign national flight attendants do not speak English as their native language. If they do speak English, there is a likelihood that they will revert to their native language under stress. American proposes to staff flights with 100% foreign national flight attendant crews, but has announced no plans to insure that these crews will be able to communicate with English speaking pilots, navigators, and flight engineers. Presently there is no Federal Aviation Administration requirement that foreign national flight attendants be proficient in English.

Federal Aviation Administration has recognized the need for strong English language skills on the part of pilots, flight engineers, and navigators. FAA regulations require that these categories of crewmen be proficient in both spoken and written English. Precedent exists for the limitation of foreign nationals in flight crews. The FAA regulations call for the Administrator to approve the use of foreign national pilots, navigators and flight engineers. American Airlines President Robert Crandall has in another instance rejected the use of foreign national labor when safety would have been compromised. In that instance Crandell decided against shifting maintenance functions to overseas bases.

APFA is concerned that safety considerations are being abandoned as American expands to become a truly international carrier. We urge Congress and the FAA to take whatever regulatory and legislative steps needed to ensure that all flight crew are proficient in English so that the safety of crew and passengers are adequately protected.

Thank you for your time. I welcome any questions that you may have.

STATEMENT OF

DON M. NEWMAN

UNITED STATES REPRESENTATIVE

INTERNATIONAL CIVIL AVIATION ORGANIZATION

BEFORE

THE SUBCOMMITTEE ON AVIATION

OF THE

HOUSE COMMITTEE ON PUBLIC WORKS AND

TRANSPORTATION

MAY 24, 1990

Mr. Chairman and members of the Subcommittee on Aviation, you are to be complimented for holding this hearing on pilot/air traffic controller (ATC) communications issues. The transmission of information from ground to air, and air to ground is critical. The problems encountered in communications difficulties between pilots and controllers can be very, very serious. It can be complicated further when the English used is a second language to that user.

The International Civil Aviation Organization (ICAO) was developed after WWII to enhance international civil aviation's safety and security. Today, 163 countries belong to ICAO which is located in Montreal, Canada. English was adopted as the language to be used on international flights and controls. However, it should be kept in mind that local controllers and local pilots use their own native language almost exclusively, outside of those dealing with international flights.

What this means is that most of the foreign flights arriving in the USA are long distance ones, and only a few of them originate in an English-speaking country. Things can get complicated if the crews are fatigued, the air traffic control environment is stressed, and flight conditions are adverse.

As a current commercial pilot with 47 years of experience with a multi-engine and instrument rating, I can say that you can have English as a primary language, and still get confused. When the pressure builds up and the interference is high on the radio transmissions due to atmospheric or man-made conditions, it can be a challenge to communicate clearly and concisely even in English. But, clear and concise terminology is what is required in today's aviation communications. The nation's major hubs, because of capacity pressure, demand clear and concise communications.

All of the pilots flying outside of the USA comply with ICAO ATC and communications standards that are accepted and applied all over the world. This includes American pilots who, of course, encounter certain differences in the quality of English spoken. But, when foreign crews arrive in the USA they are confronted with a non-ICAO ATC environment.

In spite of this, the records and the reports do not include many incidences/accidents of pilot/controller confusion because English is a second language. Some of this is undoubtedly due to the fact that records are sparse on this problem. In approximately the last two decades in which over 14,000 incidences/accidents have been filed with ICAO, only a few have been attributed directly to the use of English as a second language.

Even though, from personal experience, I believe the record of aircraft incidences/accidents attributable to English as a second language should be higher than recorded, there may be an explanation. First, aircraft incidences/accidents are not catagorized in ICAO on the basis of communication problems generally. Secondly, many countries keep poor records, and in some, such records are nonexistant. Also, some refuse to provide such information. And thirdly, the largest factor in aircraft incidents/accidents has historically been attributable to "pilot error," which in the final analysis may or may not be due to problems encountered because English is a second language.

Inasmuch as we do not have much factual evidence, let me share some ancedotal evidence:

-- On 11/15/78, a twin engine Cessna 310 in a European environment, on a VFR flight, was diverted from one airport to another because of poor weather. The pilot was unfamilar with the area and because of language problems did not understand the ATC instructions. During a low level VFR transit between two airfields, he maintained the last heading and altitude from ATC. The aircraft flew into a cloud-covered hill. All three on board were killed.

-- On 3/29/85, a Boeing 727-200 with 152 people on board, struck a 26-foot tall light standard 2,640 feet beyond the end of runway 23R in Mexico City. The aircraft continued uneventfully to Dallas, Texas. The incident was precipitated because the ATC clearance was not understood, and the aircraft made an intersection take-off with the usable runway reduced by 2,800 feet at a density altitude of 10,000 feet mean sea level (MSL).

-- On 5/28/85, a Boeing 747-SR collided with an MU-2S on the 18 runway in Tokyo, Japan on its landing roll. Both the MU-2S's pilot and co-pilot believed they had received a take-off clearance to enter the runway, even though it had not been issued by the control tower.

This presentation has intentionally omitted any domestic pilot/controller confusion created by communications difficulties. Even though ICAO has some records of these U.S. incidences/accidents, the FAA records are more complete and comprehensive.

In the final analysis, there are problems in communications involving pilots and controllers for whom English is a second language. However, ICAO does maintain the records that would indicate its magnitude. ICAO records of approximately the last two decades indicate only a few of the over 14,000 incidents/accidents recorded are attributable directly to the use of English as a second language. Pilots and controllers who deal internationally, would intuitively say that there are more.

Mr. Chairman, I appreciate this opportunity to share my concerns over this issue with you and the committee. I will be happy to respond to questions either here or through correspondence. Thank you.

STATEMENT OF RAY L. SPICKLER
EXECUTIVE VICE PRESIDENT,
NATIONAL AIR TRAFFIC CONTROLLERS ASSOCIATION
BEFORE THE HOUSE PUBLIC WORKS AND TRANSPORTATION SUBCOMMITTEE ON AVIATION
ON PILOT-CONTROLLER COMMUNICATIONS
MAY 24, 1990

My name is Steve Bell and I am President of the National Air Traffic Controllers Association. NATCA is the union representing the nation's air traffic controllers.

We are most grateful that the subcommittee is holding this critical hearing on pilot-controller communications. All of us in the aviation community are aware of the tragic circumstances surrounding the crash last January of Avianca 52. Although we do not want to second guess the National Transportation Safety Board, which will soon hold hearings, it is obvious that pilot-controller communications were a critical factor in the accident.

On the evening of January 25, 1990, controllers in the New York area were hearing from many pilots that they were low on fuel. This was not unusual, nor dangerous given the bad weather on the East Coast and that most of these flights were near their destinations. Unfortunately, the Avianca flight crew never declared a "fuel emergency" or "minimum fuel," both of which would have triggered an emergency response from controllers.

NATCA has long contended that the Avianca 52 crash was the direct result of the English-speaking member of the flight crew not fully understanding established and standard phraseology. It was a lethal mistake as he did not communicate to controller personnel the gravity of the fuel situation aboard his doomed aircraft.

We could spend countless days revisiting all the circumstances and details surrounding Avianca 52, but that it is not the point of this hearing. Avianca 52 was a cruel interpreter of the demands, needs and vulnerability encountered in today's pilot-controller communications environment.

First and foremost is the fact that correct phraseology must be used to ensure correct communications. Given the number of aircraft operations that controllers are working today, brevity and precision of communications are indispensable. There is little opportunity to interrogate a pilot or play 20 questions, especially if you are handling 20 aircraft at one time and in bad weather. Controllers rely almost exclusively on pilots to inform them of any problems on board the aircraft. This is aviation's division of labor and responsibility and we all acknowledge it. Controllers have no desire nor reason to jump into the cockpit to make decisions. We have the highest professional regard for the pilots and we have an excellent working relationship.

Since communications are critical to the safe and expeditious handling of aircraft, yet so susceptible to breakdowns, it is amazing that the FAA requires that the English-speaking flight crew member to be knowledgeable of ATC rules and procedures, including phraseology, but has no monitoring mechanism to insure compliance.

Obviously, the FAA is failing to get across the importance of terminology and idiom. Some organizations, such as ALPA and IFALPA have suggested that it would make more sense for the FAA to work with ICAO to establish an international standard terminology for limited fuel conditions, or minutes of fuel left until fuel exhaustion. Under this plan, U.S. controllers would also be educated to the change so they would be ready to communicate with a pilot or first officer who has a working comprehension of English, but not of U.S. aviation phraseology.

NATCA believes that this proposal has great merits. However, we are slightly concerned that it might open the floodgates to additional ad hoc mixing of ICAO and FAA phraseologies. We might make the situation worse by further confounding pilot-controller communications. To avoid this confusion, NATCA believes that in the long run, it would be best to stick with just one standard phraseology. It might be ICAO's or the one we use today, but let us make sure everyone is communicating on the same wavelength.

Given the fact that phraseology is difficult for many foreign pilots, it is dumbfounding that the FAA does not effectively communicate to foreign carriers vital route information. Our members tell us that foreign pilots invariably have stale preferential route data versus their domestic counterparts who are in the "loop" when it comes to up-to-the-minute information. Controllers often have to read the new routes two or three times to foreign pilots and this is both time consuming and difficult to comprehend for some of the designated-English speakers.

NATCA also suggests a program for foreign carriers modeled along one made by ANA All Nippon two or three years back. The carrier requested that controllers from Washington and New York Centers fly with their pilots to explain the airspace, procedures and phraseology. It was the equivalent of a familiarization, or FAM flight, but it was for the pilots' benefit. Unfortunately, for staffing or other reasons, the project was shelved, but that does not mean that the concept was flawed. Rather than a sterile textbook, this was a hands-on method of showing the ropes to foreign pilots new to the U.S. NATCA hopes that the subcommittee could influence the FAA and the DoT to reconsider this proposal, and with an open mind to the growing problems we face today.

Phraseology for general aviation also warrants improvement. Quite surprisingly, the FAA has no phraseology testing requirement for new pilots. They learn though their instructor and by osmosis. Even more surprising is that instructors do not have to be tested in phraseology, so any misunderstandings in phraseology are passed on from generation to generation of new pilots.

Because the FAA does not stress phraseology, controllers often find themselves engaged in lengthy, piecemeal and superfluous communications with general aviation pilots who are often requesting something as simple as a clearance or flight filing. In the process, overloaded frequencies and an already short-staffed work force are tied up.

One cannot blame the general aviation pilots. NATCA's Safety Committee Chairman, who has been a controller for almost 20 years at the Washington Center, told me that if he has a moment, he will explain to the pilot correct phraseology. One pilot with 20 years of flying under his belt thanked him, saying that for the first time he knew the right way to request a VFR flight filing.

Although the Aircraft Owners and Pilots Association is trying to provide phraseology information to its members, it is the FAA which should accept the ultimate responsibility for ensuring that general aviation pilots have solid phraseology and communications skills. At the very least, a basic course in phraseology should be required in initial pilot training and students should be tested on it to receive certification. In addition, the FAA should stress frequency discipline. Many general aviation pilots key their mikes without waiting to hear if someone else is on the frequency, causing a squelch in the controller's ear. A firm foundation in these basics would produce better pilots and a safer and more efficient air traffic control system.

There are some additional inexpensive quick fixes that could contribute to better pilot-controller communications. The first is the proposed reclassification of airspace designations. Our present system is unwieldy and most confusing, especially to foreign pilots. The new simple, single letter designation would be much easier to understand, and could prevent unintentional airspace intrusions. The same logic should be applied to a nationwide taxiway identification or labeling system. The taxiway systems that we have today are byzantine and can lead to runway incursions. The rule of thumb should be to simplify to all extent possible.

One other nagging communications problem in this category is similar call signs, such as American 1132, American 1142, and American 1152. Suppose you have two pilots waiting for a clearance. It is very easy to confuse a call sign when the phonetics are close to one another. The situation is further complicated by the "hearing-what-you-want-to-hear" syndrome which is also encountered when a pilot incorrectly acknowledges a clearance to another altitude.

Therefore, NATCA suggests that airlines monitor their use of call signs, especially at their hub airports, and vary them as much as possible. The carriers should look closely at both departures and arrivals, because under the hub-and-spoke concept, both are often operating at the same time.

Unfortunately, many of the pilot-communications problems cannot be solved with a phraseology course or a change in language. The shortcomings are rooted in more fundamental problems: staffing and equipment. As I said almost two years ago, we don't have a Tower of Babel as much as we have too few controllers in our Towers, Centers and TRACONS.

The latest FAA air traffic figures show that the present work force is handling 12 million more operations than in 1981 but with 3,000 fewer FPLs. Prior to the strike, there usually were a radar controller, a hand-off controller for inter- and intra-facility coordination, and yet another controller to perform flight data duties. In many cases today, there is one controller juggling all three jobs. The impact on communications is severe.

What is extremely puzzling is that before the 1981 strike, controllers were told by management that it was unsafe to work a sector alone. And this included situations where there were no flight data strips, inbounds, or talking on the frequencies. Suddenly on August 3, 1981, everything changed. We know of some managers who do not like a one-person sector but it has become a unpleasant fact of life that shows no sign of changing.

In terms of communications, this means that the controller's attention is being taken away from listening to the frequencies to answering land lines. There is a running joke between commercial pilots and controllers that illustrates this point. If a pilot does not respond at first to a controller's transmission, the pilot might quip, "Sorry, I was on the hand-off line," because that it is what controllers often say when they are so tied up by the additional duty. I would add that after a frequency change is given, many pilots will say, "You guys have a nice day." We appreciate the good wishes, but the plural "guys" is wrong. There is usually just one controller at the other end of the headset.

Low staffing also determines that the controller has little extra time to communicate or interrogate a pilot on flight conditions. Transmissions are very quick, often in machine gun or staccato bursts, and it is imperative to get as much pertinent information as possible into each communication. Without the phraseology shorthand, we could not handle the number of aircraft we do today. We cannot stress enough that if this stripped-down, abbreviated version of English is being utilized, everyone better understand the jargon.

Equipment is yet another problem. Many of the members of the subcommittee are aware of the recent "USA Today" survey that was conducted last month at NATCA's convention. An overwhelming 82 percent of the 200 NATCA facility representatives who responded to the survey said that equipment caused a dangerous situation; only 5 percent had full confidence in their equipment. Much of this no-confidence was directed towards the communications equipment, some of which dates back to the 1950s. The switching boxes at the Washington Air Route Traffic Control Center still have the Department of Commerce serial numbers on them.

You would be hard pressed to find a controller who is satisfied with present frequencies and coverage. Due to a lack of dual sites, it is often impossible to talk to aircraft in certain areas. The frequencies themselves are bad. They are often too close together, resulting in cross talk, and there is interference as well. The NTSB is currently investigating an accident in North Perry Airport in Hollywood, Florida. Pilots there complain that they hear transmissions from Easy Listening JOY 107 when they tune to the tower frequency and are on the same approach path as a student pilot was, before his fatal crash with another aircraft.

It is also impossible to create a new airspace sector since there are not enough new frequencies. The FAA and the Federal Communications Commission have to go back to the drawing board and come up with a plan where we get more frequencies because we cannot make do nor expand with what we have today.

Equipment problems reach down to the phone lines themselves. In the smaller VFR towers, the phone lines are sometimes so antiquated that only a few veteran phone company technicians can repair them. What is also frightening is that you can have the most sophisticated air traffic control computer system in the world, yet a man with a backhoe can cripple it in a matter of a second by cutting through a cable. This happened only last month at the Cleveland Center. If we are speaking of communications integrity then we must also focus on what links up all of these fragile components. This will become particularly critical to safety if the FAA proceeds with its ill-conceived Area Control Facility (ACF) Plan.

And what about the controllers themselves and their communications abilities? Every six months a controller is given an over-the-shoulder evaluation of his or her communications skills, including phraseology. However, little has been done outside of this routine to educate the ATC work force on ways to improve pilot-controller communications. In other words, overall skills are good, but they could be better and the FAA is not much help.

As the users and providers try to make their way through this communications morass, the FAA tells us that some technological magic bullets are on the way that will solve most of our problems. But once again, what about the human factor? For example, Data Link is a good concept and NATCA has high hopes that it will be a valuable supplemental communications tool for pilots and controllers. However, will automation merely shift our communications problems from the oral to the visual? Will Data Link cause a reduction in cockpit workload while at the same increasing controller workload? What is the proper mix of oral and visual communications? Does a pilot react stronger to a visual or spoken air traffic control message? These and scores of other difficult human factor questions have to be answered before we make that next big step in technology, and the FAA has been slow to react to them.

Given everything I have said, I find it exasperating that on November 1, 1988, I stood next to then FAA Administrator T. Allan McArtor as he announced the Pilot/Controller Communications Awareness Initiative or "Call to Action" This massive education program was supposed to "foster improved communications between pilots and controllers as a means of reducing system operations problems, increasing user professionalism and enhancing system safety." The professional group of aviation users and providers, or "Initiative Working Group," of which NATCA was a member, identified 12 problem areas which it hoped could be addressed through an "extensive information campaign," including a mass distribution of the "Call to Action" brochure.

What happened to this so-called campaign? Your guess is a good as mine. The FAA stated it "fully" supported the plan and urged each system user "to respond to this 'Call to Action' by making a commitment, as FAA has done, to increase system efficiency and safety through improved communications." However, the majority of controllers never received the "Call to Action" brochure; most copies are probably still sitting unopened in their packing boxes. We can only assume that the FAA's commitment to the program and document was fairly short lived, or perhaps the initiative fell though the cracks as so much does given the very short tenure of the Agency's administrators.

NATCA, and I am sure most of the other organizations who participated in the Initiative, want to see the FAA recommit itself to the "Call to Action." Those 12 areas of vital concern are as vital today as they were two years ago. The concerns have not gone away, the only thing that has is the program.

In conclusion, NATCA believes that some measures are being taken to improve communications between controllers and pilots, but the FAA's meager actions are dwarfed by the magnitude of the problem. After all, communications are the key to air traffic control. If pilots and controllers do not understand each other, all of the expensive NAS Plan equipment will not be worth a penny.

The FAA must rededicate itself to educating the users and providers of the system, and get those users, both foreign and domestic, intimately involved in improving pilot-controller communications. The Agency must also realize that as the airspace becomes saturated, so do communications. At times, Controllers are working too many aircraft and because of the burden, communications invariably suffer. Instead of always trying to defend an indefensible position, the Agency should start getting the "communications" word out and start getting enough qualified personnel and modern equipment on line to do the job.

ADDITIONS TO THE RECORD

Allied Pilots Association

June 12, 1990

The Honorable James L. Oberstar
Chairman
Subcommittee on Aviation
Room 2251, Rayburn Building
Washington, D.C. 20515

Subject: Pilot/Air Traffic Controller Communications Issues

Dear Sir:

In concert with the recent Congressional hearings on pilot/controller communication problems, the Allied Pilots Association strongly advocates the procurement of aircraft anti-blocking equipment to ensure receipt and transmission of pilot/controller communications.

Anti-blocking equipment for aircraft communications radios will give the pilot/controllers the electronic help that will significantly enhance safety and improve communications efficiency. This equipment has been successfully flight tested both in the United States and Europe and minimum operational performance standards that will allow manufacture of effective equipment have been written by RTCA Special Committee 163 and now await RTCA Executive Board approval.

These minimum operational performance standards (MOPS) call for protection against both continuous (stuck-mic) and simultaneous (step-ons, slips, etc.) blockage of voice communications. The RTCA Committee 163 labored for three years in arriving at these standards which should be adopted in their entirety and thereby provide the full protection that is needed. A splitting of these standards to combat only the stuck-mic problem has been suggested, and that will reduce the safety benefits by at least one-half.

Some who argue against the full adoption of the standards say that the FAA cannot be trusted to wisely implement rulemaking on anti-blocking protection. Sensible implementation was called for in the 1983 petition for rulemaking, 84-PR-5; Docket No. 23755. A review of this docket will show a large majority of the response to it were favorable including support from seven pilot unions from around the world. One major airline captain document 118 blocked transmissions during one month's experience flying the Boeing 727. The petition quite properly calls for requiring anti-blocking equipment in the high density airspace around the major airports in the United States. Universal implementation is not needed; the small plane operator in the less dense airspace does not need to be forced to add this protection.

p.o. box 5524 — arlington, texas 76005-5524 — 214-988-3188

New equipment, modification, and retrofit are covered by the MOPS. The retrofit, or plug-in equipment, would require no aircraft modifications; e.g., an anti-blocking microphone plugs into existing radio jacks in the cockpit. Modification will apply to existing audio panels and/or radios. Designing the circuit into new radios is possible with an increased cost to the manufacturer as low as 2%. For example, the NARCO COMM. type radio manufacturing cost increase would be approximately $30.00. The costs to the government, aircraft owners, and industry is minimal for the benefits that will be realized. Safety will be enhanced and communications efficiency will result in less delays and some fuel savings.

The MOPS will require no change to the cockpit with anti-blocking radio equipment installed; no additional lights or switches are required, although they are optional. Options will allow flexibility to operate in emergency or special traffic conditions. Operationally, a radio equipped with an anti-blocking circuit transmits and receives with the same power, range, and clarity as it would without the protective circuitry, but it will not step-on or interrupt/block an ongoing voice transmission. It was simultaneous blockages (step-ons, clips) that contributed to the loss of focus of the controller involved in the Atlanta accident of January 18, 1990, between Eastern Airlines Flight #111 and King Air N44UE.

The FAA, in testimony tc this committee, acknowledges the need for solutions to the problem and cites remedies such as 20 changes to the controller's handbook, reviews of phraseology, additional controller training, and the need for effective communications. In fact, they say communications misunderstandings are a major factor in operational errors; but they view the "spectrum of communications problems as being within the broader context of what has been known as human factors." Their 1991 budget for human factors research is $17.2 million. $3 million was the ATA estimate for anti-blocking equipment for all of the ATA member airlines, according to their docket input. While publications like A Call to Action and a national human factors program may improve safety, anti-blocking radio equipment will help pilots and controllers with all types of accents and communications problems now. No matter what radio procedures are implemented, this hardware deficiency should be corrected.

Hopefully, this subcommittee will ensure that the FAA proceed with sensible rulemaking as proposed in the petition for rulemaking.

Sincerely,

F.R. Vogel

F. R. Vogel
President

FRV:dmh

Attachments 2

ATS INADVERTENT FREQUENCY BLOCKAGE SURVEY
(SEPTEMBER 1980 - FEBRUARY 1981)

FACILITY			USER GROUP					AIRCRAFT AFFECTED		TIME	STATUS		WAS AC INFORMED				
TERM.	ARTCC	FSS	A/C	GA	MIL	UNK.	OTHER	YES	NO	HOURS	YES	NO	YES	NO	SE	SD	NMAC
1345	313	72	345	503	52	810	20	1141	589	391.4	869	861	846	884	2	0	0

- 1730 INCIDENTS - APPROXIMATELY 3 TIMES THE AMOUNT IN 1978 SURVEY.
- 78% OF INCIDENTS OCCURRED IN TERMINAL AREA.
- OTHER AIRCRAFT OPERATIONS AFFECTED IN OVER 70% OF INCIDENTS.
- 391.4 HOURS OF FREQUENCY BLOCKAGE.
- SYSTEM ERRORS OCCURRED IN TERMINAL AREA.

POTENTIAL SOLUTIONS/PREFERRED TECHNIQUES: Each type of coordination has a place and can effectively communicate what the controller desires. The controller must be aware of the traps involved with each type of coordination communication. In some cases, miscommunication can be worse than no coordination at all.

BLOCKED OR SIMULTANEOUS TRANSMISSIONS

STATEMENT OF THE PROBLEM: Generally, simultaneous transmissions on the same frequency in proximity to the same intended receiver are frequent and self-defeating phenomena detrimental to effective communication of vital traffic movement and control information. Initiation of a transmission on an occupied frequency can (and does) result in vital information not being received by the intended ATC facility or aircraft.

BACKGROUND AND HISTORY: Disruption to voice communication in the ATC system presents the potential for degrading flight safety. Although these communication disruptions may occur in areas where traffic density is low, the growth of air traffic (and communication exchange) has increased the number of disruptive incidents.

In 1984, the FAA was petitioned to enact rulemaking to require anti-blocking circuitry that would preclude transmissions from activating on a frequency already in use. The FAA published the petition to the public comment and received favorable responses. Because an industry standard for such devices/circuitry is not available, FAA deferred action on the petition and asked the Radio Technical Commission for Aeronautics (RTCA) to establish a special committee to develop appropriate guidance and equipment standards. RTCA Special Committee 163 was formed to develop design guidance both for anti-blocking devices and for a means to terminate unintentional/inadvertent continuous transmissions (stuck microphones).

Special Committee 163 met for the fifth in a series of sessions in May 1988. The committee refined and expanded second draft minimum operational performance standards (MOPS) for devices that will prevent ATC frequency blockage by unintentional prolonged radio transmitter keying (stuck mike) and simultaneous transmissions.

SPECIFIC EXAMPLES OF PROBLEMS: Paragraphs 191 -- Radio Technique and 235 -- Communications, stress the importance of listening before transmitting and of clearly communicating with ATC.

POTENTIAL SOLUTIONS/PREFERRED TECHNIQUES: The most basic human factors solution is for controllers and pilots to listen before transmitting on the frequency. Except for a few situations where some frequency overlap occurs, if someone else is talking on the frequency, keying the transmitter will be futile and will probably jam the receivers, causing the other transmitter to have to repeat and adding to frequency congestion. Equipment solution: RTCA Special Committee 163 efforts will culminate shortly for minimum operational standards for anti-blocking devices to be installed on aircraft through retrofit, modification, and/or via incorporation into new radios. Various levels of sophistication, technology, and costs will likely be considered. When the draft is finalized, it will be presented to the RTCA Executive Committee for review and approval and then to the FAA. Afterward, FAA will have to respond to the recommended standards, issue applicable NPRM's, resolve comments, and publish the final rulemaking.

STUCK MICROPHONES

STATEMENT OF THE PROBLEM: The pilot's microphone, a most vital link in the air-ground communications process, on too many occasions has been the disruptive link in the chain, not only for the pilot whose microphone was stuck but for others sharing the frequency--and the airspace--with that pilot.

BACKGROUND AND HISTORY: Perceiving a problem of significant proportions, the FAA air traffic control personnel have been working to reduce the safety-impacting potential for stuck microphones in pilot-controller communications. Surveys made periodically from 1968 through 1981 reflected major increases in the occurrences of disruptive stuck microphone situations in the ATC system. The number of incidents affecting aircraft separation and control doubled from 1968 to 1978 and tripled by 1981 over a similar survey period. Subsequent incident and operational error reports substantiate the continued problem.

Survey facts: 1730 incidents occurred in the system between September and February. Of these, 78% occurred in terminal areas. Other aircraft operations were affected in over 70% of the recorded incidents. 503 incidents were attributed to general aviation aircraft, 345 to air carrier, 52 to military, 20 to ground vehicles/other, and 810 caused by unknown sources. Results included a total of 391.4 hours of frequency blockage accumulated and numerous system operational errors occurred.

Microphones rarely become keyed by mechanical failure. Operator error is often the direct cause of unintentional continuous microphone keying. The problem becomes serious when inadvertent keying causes a complete and prolonged frequency blockage for several minutes in an environment where separation of aircraft is dependent upon timely communications to or from ATC.

SPECIFIC EXAMPLES OF PROBLEMS: Unsatisfactory Condition Report: (Air Carrier) had a stuck mike during peak rush period at O'Hare. Numerous aircraft were converging and descending for sequencing into the O'Hare terminal complex. (Air Carrier) mike remained stuck for approximately 5 minutes; this rendered all aircraft on frequency 135.9 incapable of receiving control guidance, causing an extremely dangerous situation and system delays to over 25 aircraft.

Daily Operations Report: Departure delays at Newark of between 19 to 23 minutes due to mike stuck on Newark frequency between 1323Z and 1333Z. Airports impacted included Newark (4 departures averaging 22 minutes each) Other adjacent facilities were also impacted. LaGuardia (45 departures averaging 20 minutes each), and other adjacent facilities.

Report of Near Midair Collision Report: A near midair collision occurred between (air carrier #1) and (air carrier #2) in vicinity of Livingston VORTAC in which a stuck microphone kept air crews from hearing separation instructions from Atlanta ARTCC. (Subsequent investigation of FAA Flight Standards personnel found air carrier #1 had a mike continuously keyed for over 5 minutes.)

Correspondence submitted to a leading industry organization clearly illustrates the importance of pilot vigilance in the area of monitoring radio equipment for potential problems:

"I would like to mention a radio problem that hit me recently... a stuck mike. Fortunately i was in a small airport, XYZ to be exact, and the pattern was active but nothing compared to ABC Municipal which was close by. It was probably 110 degrees in our cabin and I had just refueled and was anxious to get back up to cool air. I finished my run up and asked for permission to take off and suddenly realized I couldn't hear the tower, or anything for that matter, but my own voice. Then it hit me. I had a stuck mike. Normally this would not be a panic situation. All I needed to do was unplug the mike and go to an alternate. However in this case my mike switch was a small button behind the control wheel and when it was depressed there was nothing to grab hold of and pull out. In addition there were no external plugs to disconnect. In total frustration and confusion I told the tower of my problem and that I would return to the line. I was so involved with my situation I failed to realize the tower was helpless as long as my mike was stuck. Suddenly it released and I switched to a hand mike rather than risk further complications and called the tower for taxi clearance. The controller was less than happy with me, and let us cook for another five minutes before clearing us for takeoff. While sitting there like a lobster in a pot I had time to realize how serious a stuck mike would be in a major terminal. It wasn't until I was airborne that the thought hit me I could have turned the radios off, or better yet I could have switched

J.R. Niedmeyer
Chairman
Stuart Matthews
Vice Chairman & Treasurer
R.R. Grey
General Counsel-Secretary

Flight Safety Foundation

J.H. Enders
President
R.F. Nelson
V.P. & Asst. to President
E.R. Arbon
V.P. Operations

2200 Wilson Boulevard, Suite 500, Arlington, VA 22201-3306 U.S.
703 • 522-8300
Telex 901176 FSF INC AGTN
Fax 703 • 525-6047

30 May 1990

Hon. James Oberstar
Chairman
House Public Works and Transportation
Aviation Subcommittee
Rayburn House Office Building
U.S. House of Representatives
Washington, D.C. 20515-2308

Dear Mr. Oberstar:

Flight Safety Foundation has been a champion of more effective ground-air ATC communications for many years. Your May 24 hearing is the latest in a series of meetings on this topic, and I regret that we were unable to attend.

Our 1974 27th Annual International Air Safety Seminar was held in Williamsburg, VA, with the theme "Human Factors in Safe Flight Operations." It was the first major international conference that focused on the problem of human frailties as they affect safety of aviation.

Many of the papers presented and discussed at that seminar touched on the problems of effective communication throughout the entire aviation operation. I believe that, in general, communications within the air carrier operating organizations and between operators and manufacturers has steadily improved. Fokker's "Simplified English" approach is one of the latest developments that helps to improve understanding among people of different language background, especially in airworthiness matters.

ATC-flight crew communications are often much more critical, occurring as they do in real-time, split-second decision-making circumstances. We have had several discussions of this continuing problem with not only our airline members but with several regulatory authorities.

The Avianca tragedy is the latest in a series of incidents and accidents where ineffective communications have been factors. The Flight Safety Foundation distributed the enclosed reprint of the NTSB report immediately on its release, to our 540 member organizations in 71 countries to underscore the importance of effectively communicating. We are beginning to receive some very thoughtful responses to this bulletin which we will share with our members.

An International Organization for Everyone Concerned with the Safety of Flight

Air ground communications language problems occur throughout the world. In some areas, national pride discourages a full embrace of English as the international aviation language, so that ATC communications are frequently conducted in two languages, depriving aircrews of vital situational awareness in congested airspace.

The major complaints FSF has heard from non-U.S. operators operating in U.S. airspace (and which have informally been conveyed to FAA from time to time) are: difficult-to-understand regionally-accented American English, rapidity of delivery, extensive use of jargon or non-standard phraseology, and crowded radio traffic that makes it difficult for non-U.S. crews to interact in a timely and effective way.

While there were some non-ATC factors present in the Avianca accident, the final safety net of clear understanding between the aircrew and ATC was certainly not present.

I enclose for your information, the referenced FSF bulletin distributed to our members and a copy of a talk I delivered to ALPA four years ago on "Communications".

Should you wish to explore any of these thoughts further, I would be pleased to meet with you and/or your staff to do so.

Sincerely,

JOHN H. ENDERS
President

Encls.

cc: Hon. James Kolstad
Hon. James Busey
J. R. Riedmeyer

Communication

by John H. Enders
President
Flight Safety Foundation
Arlington, Virginia

Presented to
Air Line Pilots Association
Air Safety Forum

Mayflower Hotel
Washington, D.C.
July 14-16, 1986

COMMUNICATION

John H. Enders
President
Flight Safety Foundation
Arlington, Virginia

I extend our thanks to ALPA for inviting the Flight Safety Foundation to participate in this Air Safety Forum, and in particular to share our thoughts about the business of communicating safety information.

Flight Safety Foundation's reason for existence is to communicate aviation safety information and to encourage others to share information that could prevent an accident. In the six years since I became directly associated with the Foundation, I have given a lot of thought to the art of fostering better communication within the world-wide aviation community. I conclude that, for all our accumulated wisdom and knowledge about communications technology and human interaction, we do not manage large complex systems very well.

Communication is the life blood of human interaction; it is no less the matrix that makes possible the achievement of complex tasks. By communication, I mean here both the sending and the receiving of information. The human is both the key to the process and its weak link. We have the capability of inventing and constructing ever faster ways of transmitting complex information of constantly increasing fidelity, but we also have that very human weakness of poorly phrasing what we mean to say or not listening to what is said to us.

This problem extends to visual portrayal. We are still finding surprises in fidelity requirements for visual simulation.

Conceptually, many airlines are still struggling with video presentations of the cabin safety message. A few overseas airlines have exploited the video medium beautifully, by demonstrating actions that could not be done in real-time every flight, such as the actual emergency opening of doors, inflating vests and rafts, explaining why cigarettes must be doused when oxygen is used tion about wind shear by one of the pilots. He answered the question and then suggested that the pilot would find a lot more information in a recent FSF Accident Prevention Bulletin. The pilot was unaware that FSF published any information and asked where he could get a copy. Homer replied that two sets of our publications were routinely shipped to their organization. Further investigation revealed that the FSF bulletins were neatly filed in binders, year by year, in a bookcase in the VP-Flight Operations office, placed there by his faithful and efficient secretary. Even the VP had not read them. ("Horse-watering" problem)

- Many regional airlines are so small, they do not have the organizational depth to assimilate a lot of written safety material and no dedicated safety manager to organize the information for the employees. (No communication)

- In early examinations of the U.S. ATC system following the PATCO strike, FSF, NTSB and the Jones Committee discovered inadequacies in the vertical flow of communications within the FAA, especially upwards. Not surprisingly, FAA is not alone in this situation. NASA, DOD, and large complex private corporations have similar problems. Most of the time, the problem is not immediately critical, but it is erosive to morale and organizational efficiency/productivity over time. This is a case where perceptions dominate. If an employee *perceives* that his or her message is not getting through to management and getting a fair hearing, the communication process has failed. One of the successes of a U.S.-sited Japanese auto factory has been the reduction to 48 hours to act on an employee complaint. For this year, their backlog has averaged about 2 complaints, down from several hundred when they first took over the plant from the previous managers. Needless to say, employee morale and productivity are high.

- Some of our member-designated recipients hold our information, and limit exposure of their employees only to certain items. (filtered communication). This practice suggests some lack of trust or worry that people might get the wrong ideas about safety.

- On the positive side, many of our member organizations distribute our publications throughout the maintenance and operations groups.

- Many of our overseas airlines translate part or all of our bulletins into the local language for their personnel.

Interdepartmental/Interpersonal: The importance of good communication at these levels is evident in all of our experiences. LOFT and CRM are built around producing high quality communication. Scandanavian Airlines System has spent 2 years developing an interpersonal approach within their airline to improve quality control and thereby safety and efficiency. SAS management has recognized the importance of safety in the highly competitive airline environment. The FSF July 1986 Flight Safety Digest contains SAS President Jan Carlzon's explanation of the process and his commitment to its success. I commend it to your reading.

- We have often found that some of our member organizations do not communicate effectively from department to department. One airline uses a teletype between Flight Operations and Maintenance located in adjacent buildings.

- On a visit to one of our airline members a few years ago, I asked my Flight Operations management host if I could visit the maintenance department. He was somewhat surprised, but quickly replied, "Good Idea! As a matter of fact, I haven't been over there for a couple of years myself, and I'd like to go with you!" We had an excellent visit in which the maintenance director proudly showed the engine overhaul and test facility, the quality control laboratory and avionics shop, explaining many of the problems that were occurring and relating some of them to crew familiarity problems. After the visit, the Flight Operations host was so impressed with the tour that he scheduled all of his crews for visits.

Interorganizational: As bad as some of the other communications problems appear, I think this is probably the area of greatest deficiency, since there is no single management control over all of the possible interactions between different organizations. It is functionally a structural communications problem...how to transfer the appropriate information in a timely way to prevent accidents.

Here, the effects of economics clearly come into play by often inhibiting communication. Different and often conflicting priorities and responsibilities of the various public and private organizations result in unilateral decision making that does not always favor good communications nor safety improvement. Recessionary problems, increases in oil prices, and federal budget cutting measures now followed by the impending Gramm-Rudman Deficit Reduction Act have created a tough management environment. Futhermore, the effects on internal acounting and business decisions of the Airline Economic Deregulation Act and the resulting economic competition have added to a chaotic situation that has contributed to a decrease in interorganizational communication.

Certainly, Airworthiness Directives, Service/Alert Bulletins and other critical communiques go forth. However, NTSB, FAA and NASA have had to reduce the flow of other "enhancement" information that has contributed to safety awareness and has built up the margin of safety we have accumulated. Much of that function has been transferred to yet another organization, the National Technical Information Service, through which one may now purchase reports that formerly were distributed free by the agency involved. While centralization of this function may appear to have promise, the associated government cost accounting procedures have resulted in such a complex, involuted ordering and pricing process that one is easily discouraged from trying to obtain information. In addition, the NTIS frequently lags by as much as several months making the report available to the world. This situation becomes the very antithesis of good and efficient communication.

Operationally, we see the communications problem arise in ATC, where often, due to work load, the controllers cannot go beyond their primary responsibilities of separating traffic and pass on weather information. Furthermore, production and analysis of weather information resides in another government agency that has its own budgetary priorities consistent with its primary mission. Information must be conveyed to FAA for reformatting into an operationally suitable mode. Ineffective communication from ATC also results when heavy traffic pressures induce the controller to depart from standard phraseology, which can lead to misunderstanding, especially for foreign crews entering or transiting U.S. airspace.

Short staffs in both the private and public sectors make communications more difficult and information harder to obtain. Engineering departments in many airlines have been drastically reduced or eliminated, making the transmission and interpretation of manufacturer and government instructions and data more difficult and often less thorough. The responsibility often then flows to the pilots to determine for themselves what they need to know about their operation. The control of quality information is thereby lost and the safety margin will suffer. The smaller staffing levels mean more work per individual with less time for extra reading or communicating ideas about safety that are not immediately critical, but which in the long run would accrue to the organization's best safety interests.

Travel enables one-on-one interorganizational communication with one's peers and learning from specialist conferences. It has suffered significantly during the past few years. Just look at meeting attendance. Ironically, even though good communication is essential to survival of the firm, usually among the first items to be cut is travel. Short staffs also mean that the remaining personnel cannot afford, task-loading wise, to be out of the office long enough to go to more than a 2-3 day meeting.

Gains have been made with electronic communications and computerized systems for collecting, assimilating and analyzing large amounts of data, but we must guard against losing these gains by our mismanaging of personnel resources, and the undervaluing of communications needs by nonoperational decision-makers.

These are a few observations I wanted to make about the process of communication. They are incomplete, but nevertheless, may provide some "starter dough" for your further consideration and argument. In closing, I would like to say that though FSF is often critical of safety practices, we see much that is good in industry and government. In particular, we applaud the FAA's efforts in improving the flight standards and maintenance inspection process and recognizing the need to re-educate their inspector force and that of the industry as the generational and structural changes taking place in the industry come about.

We also applaud those airlines who have discerned the new patterns of deregulated operation and are avoiding the safety traps along the way. Likewise, the supplier industry is to be praised for recognizing new needs. The radar manufacturers in particular should be commended for their response to ALPA's critique of the problems encountered in detection of weather.

I would like to commend ALPA for holding these forums, where communication is fostered in the best spirit of our business.

Finally, I would like to return to the Interpersonal Communication topic briefly and leave you with a quote from Fred Haise, Apollo 13 Astronaut: "Remember, two monologues do not a dialogue make!"

Thank you.

FSF

FLIGHT SAFETY FOUNDATION, INC.

The Flight Safety Foundation is an international membership organization dedicated solely to improving the safety of flight. Non-profit and independent, it serves the public interest by actively supporting and participating in the development and implementation of programs, policies and procedures affecting safety, by stimulating research into ways and means of eliminating accident-inducing factors, by in-depth appraisals of actual and potential problem areas in flight and ground safety and by developing possible solutions to those problems. As a vehicle of information interchange, it cooperates with all other organizations and individuals in the field of aviation safety in educating all segments of the aviation community in the principles of accident prevention.

FLIGHT SAFETY FOUNDATION, INC.
5510 Columbia Pike
Arlington, VA 22204-3194, USA
Tel. (703) 820-2777
Telex 901176 FSF INC AGTN

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FLIGHT SAFETY FOUNDATION
Accident Prevention
Vol. 47 No. 4 *For Everyone Concerned with the Safety of Flight* April 1990

Communications Problems: Immediate Corrective Action Needed

An Important Message to FSF Members from John H. Enders, President

We call attention to another tragic accident that is fraught with human factors problems, especially those related to ground/air communications and cross-language difficulties. Flight Safety Foundation is reprinting, in its entirety in this bulletin, the U.S. National Transportation Safety Board's (NTSB) Safety Recommendation, released 21 February, 1990, that concerns Avianca's Boeing 707 accident in New York on January 25, 1990.

We urge all operators and air traffic authorities to study this report. Its recommendations aim to prevent communications-related accidents.

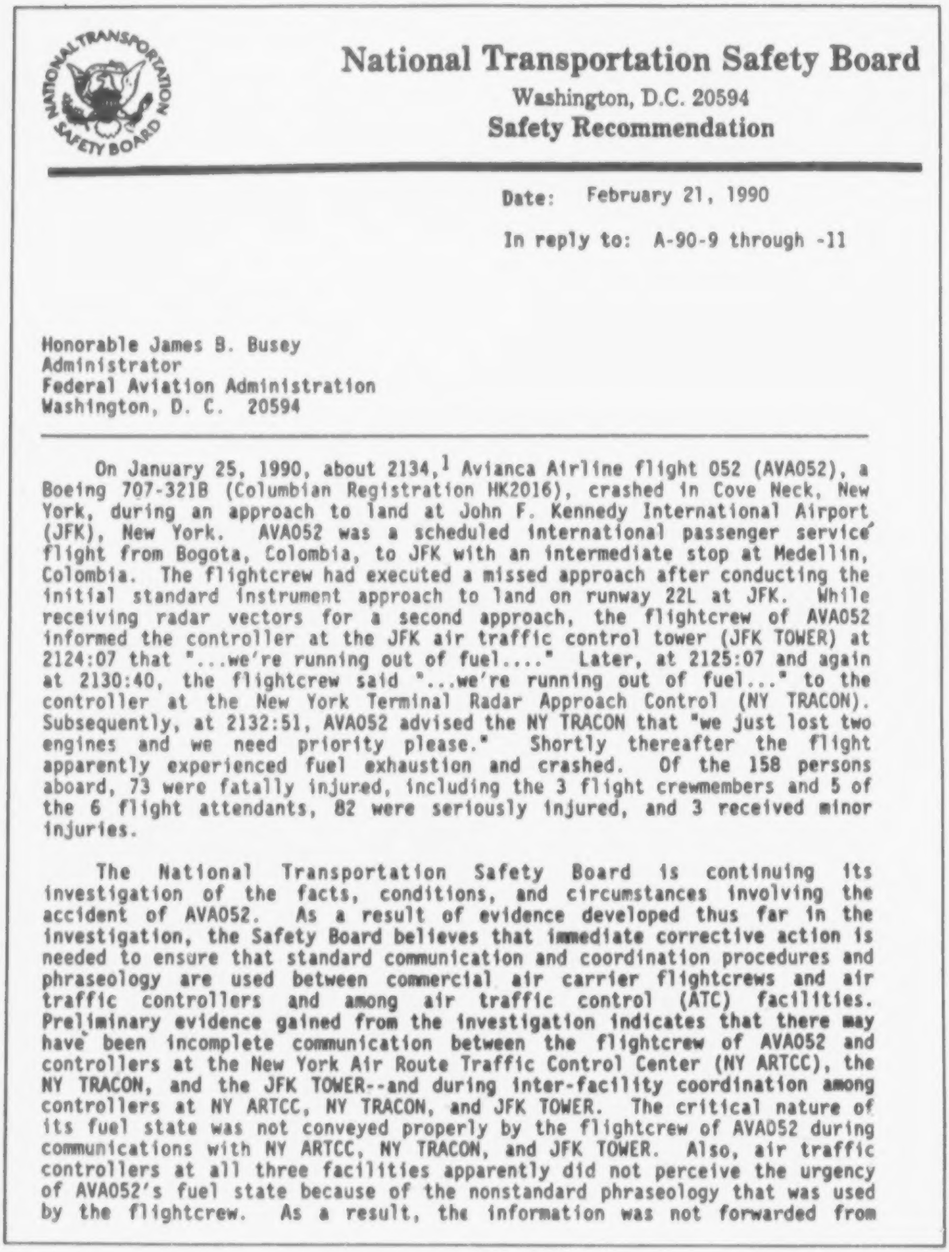
The Foundation is committed to an assertive program of facilitating the acquisition and dissemination of knowledge and understanding about human error and its causes. Our purpose is to enable our members and all involved in aviation to benefit from the collective wisdom of the international efforts underway to reduce or eliminate aviation accidents.

We solicit your comments about the communications problems experienced in the United States and elsewhere in the worldwide air traffic network. The Foundation will provide a summary of these inputs to our members, and to air traffic control authorities throughout the world, for consideration as they address this pervasive problem.

Please address your comments to:

Flight Safety Foundation
2200 Wilson Blvd., Suite 500
Arlington, VA 22201-3306 U.S.
Attn: Communications Factors Survey
FAX: (703) 525-6047 or TLX 901176 FSF INC AGTN

Full text of NTSB Safety Recommendation begins on Page 2.



National Transportation Safety Board
Washington, D.C. 20594

Safety Recommendation

Date: February 21, 1990

In reply to: A-90-9 through -11

Honorable James B. Busey
Administrator
Federal Aviation Administration
Washington, D. C. 20594

On January 25, 1990, about 2134,[1] Avianca Airline flight 052 (AVA052), a Boeing 707-321B (Columbian Registration HK2016), crashed in Cove Neck, New York, during an approach to land at John F. Kennedy International Airport (JFK), New York. AVA052 was a scheduled international passenger service flight from Bogota, Colombia, to JFK with an intermediate stop at Medellin, Colombia. The flightcrew had executed a missed approach after conducting the initial standard instrument approach to land on runway 22L at JFK. While receiving radar vectors for a second approach, the flightcrew of AVA052 informed the controller at the JFK air traffic control tower (JFK TOWER) at 2124:07 that "...we're running out of fuel...." Later, at 2125:07 and again at 2130:40, the flightcrew said "...we're running out of fuel..." to the controller at the New York Terminal Radar Approach Control (NY TRACON). Subsequently, at 2132:51, AVA052 advised the NY TRACON that "we just lost two engines and we need priority please." Shortly thereafter the flight apparently experienced fuel exhaustion and crashed. Of the 158 persons aboard, 73 were fatally injured, including the 3 flight crewmembers and 5 of the 6 flight attendants, 82 were seriously injured, and 3 received minor injuries.

The National Transportation Safety Board is continuing its investigation of the facts, conditions, and circumstances involving the accident of AVA052. As a result of evidence developed thus far in the investigation, the Safety Board believes that immediate corrective action is needed to ensure that standard communication and coordination procedures and phraseology are used between commercial air carrier flightcrews and air traffic controllers and among air traffic control (ATC) facilities. Preliminary evidence gained from the investigation indicates that there may have been incomplete communication between the flightcrew of AVA052 and controllers at the New York Air Route Traffic Control Center (NY ARTCC), the NY TRACON, and the JFK TOWER--and during inter-facility coordination among controllers at NY ARTCC, NY TRACON, and JFK TOWER. The critical nature of its fuel state was not conveyed properly by the flightcrew of AVA052 during communications with NY ARTCC, NY TRACON, and JFK TOWER. Also, air traffic controllers at all three facilities apparently did not perceive the urgency of AVA052's fuel state because of the nonstandard phraseology that was used by the flightcrew. As a result, the information was not forwarded from facility to facility, and AVA052 was not provided with additional ATC assistance and traffic priority consistent with its critical fuel status.

The Safety Board is focusing on many areas during its continuing investigation and has not concluded that any specific communication or coordination problems were causal to the accident. Notwithstanding its current position with respect to the cause of the accident, however, the Safety Board believes that the Federal Aviation Administration (FAA) should take immediate action to make certain that flightcrews operating in the U.S. National Airspace System (NAS) are thoroughly knowledgeable of the flight operating and ATC rules and procedures, including standard phraseology, for operating in the NAS; and that all air traffic controllers are alert and vigilant to communications from flightcrews, especially those involving foreign air carriers, that may convey the need to declare an emergency and provide additional ATC assistance even in instances when flightcrews use nonstandard phraseology.

History of the Flight

AVA052 departed Medellin at 1508 en route to JFK on a filed flight plan that took the airplane via an oceanic route over Bimini, Bahama Islands, and then northbound toward the east coast of the United States. The flight was cleared into U.S. airspace by ATC via Atlantic route 7 to Dixon, North Carolina, jet airway 174 to Norfolk, Virginia (ORF), direct to Sea Isle, New Jersey, and then via the CAMRN TWO ARRIVAL to JFK to maintain flight level 370[2] (FL370). AVA052 was delayed three times for ATC purposes as the flight proceeded en route up the northeast coast of the United States. The flight was cleared to circle in holding patterns over ORF for about 19 minutes (1904-1923); over the BOTON navigational intersection (near Atlantic City, New Jersey) for about 29 minutes (1943-2012); and over the CAMRN navigational intersection (35 miles south of JFK) for about 29 minutes (2018-2047). Between ORF and CAMRN, AVA052 was cleared to descend from FL370 to several lower FL's and altitudes. The flight entered the CAMRN holding pattern at 14,000 feet msl,[3] and subsequently was descended to 11,000 feet in the pattern.

At 2044:43, while holding at CAMRN, the NY ARTCC radar controller advised AVA052 to expect further clearance (EFC) at 2105 (the flight had previously been issued EFCs of 2030 and 2039). The flightcrew responded, "...ah well I think we need priority we're passing out of (garbled)." The radar controller inquired, "...roger how long can you hold and what is your alternate [airport]." At 2046:03, the flightcrew transmitted, "Yes sir we'll be able to hold about five minutes that's all we can do." The controller replied, "...roger what is your alternate." The flightcrew responded, "Ah its Boston but its ah full of traffic [I] think."

A handoff controller[4] who was assisting the radar controller at the NY ARTCC, and who was able to monitor most of the transmissions described above, initiated a call to the NY TRACON at 2046:23. The handoff controller advised the NY TRACON controller that "AVA052 just came out at CAMRN and can only do five more minutes in the hold. Do you think you can take him or should I offer him his alternate?" The NY TRACON controller responded, "What's his speed now," and then stated, "Slow him to one eight zero knots and I will take him." The handoff controller asked for a repeat of this information. The NY TRACON controller responded, "Slow him to one eight zero knots and I'll take him...he's radar...three southwest of CAMRN." The handoff controller replied, "One eighty on the speed, radar contact, and I'll put him on a forty [040 degree] heading." This coordination between the NY ARTCC handoff controller and the NY TRACON controller terminated at 2046:44.

While the handoff controller was talking to the NY TRACON, he did not hear AVA052's response to the request to identify the flight's alternate airport. At 2046:24, the flightcrew advised the NY ARTCC radar controller, "It was Boston but we can't do it now we ah we will run out of fuel now." After being advised by his handoff controller that the NY TRACON would be able to accept AVA052, the NY ARTCC radar controller, at 2046:47, instructed the flight, "...cleared to the Kennedy airport via heading zero four zero maintain one one thousand speed one eight zero." After acknowledging the clearance, the flightcrew was instructed to contact the NY TRACON. Recorded air traffic control radar data indicates that AVA052 departed the holding pattern at 2047:00.

At 2047:21, AVA052 established initial communications with the NY TRACON feeder controller. The flightcrew was provided routine radar service, including descents to lower altitudes and radar vectors, to sequence it with other airplanes that were en route to JFK. At 2054:40, the feeder controller cleared the flight to "turn right, right turn heading two twenty I'm going to have to spin you [make a 360-degree turn] sir." At 2056:15, the feeder controller advised, "...I have a windshear for you ah at fifteen ah increase of ten knots at fifteen hundred feet and then an increase of ten knots at five hundred feet reported by seven twenty seven." At 2056:24, AVA052 acknowledged receipt of the windshear advisory and, at 2102:38, the flightcrew was instructed to contact the NY TRACON final controller.

AVA052 contacted the NY TRACON final controller at 2103:076 reporting level at 5,000 feet. During the next 7 minutes, the flightcrew received routine radar service including numerous heading changes and further descent clearances to 3,000 feet and finally to 2,000 feet. At 2111:06, the final controller stated, "...you're one five miles from the marker maintain two thousand till established on localizer cleared ILS two two left," and at 2115:08 the flightcrew was instructed to contact JFK TOWER.

At 2115:20, the flightcrew contacted JFK TOWER and stated that AVA052 was "established two two left." The JFK TOWER responded that the flight was number three to land following a Boeing B-727 that was on a 9-mile final. The tower controller requested twice that AVA052 increase airspeed 10 knots for sequencing and at 2119:57 stated, "...wind one nine zero at twenty cleared to land." At 2123:33, AVA052 advised the tower controller that it was executing a missed approach. The tower controller cleared the flight to climb to 2,000 feet and turn to a heading of one eight zero degrees. The flightcrew acknowledged the clearance, and shortly thereafter, at 2124:07, told the tower, "...ah we'll try once again we're running out of fuel." The tower controller replied, "Okay." The tower controller cleared the flight to turn further left to a heading of one five zero degrees and at 2124:39 cleared it to contact the NY TRACON final controller.

At 2124:55, the flightcrew contacted the NY TRACON final controller for the second time and stated that it had just made a missed approach and repeated the heading and altitude clearances received from JFK TOWER. The final controller stated, "...good evening, climb and maintain three thousand [feet]." The flightcrew responded at 2125:07, "Climb and maintain three thousand and uh we're running out of fuel sir." The final controller replied, "Okay ah fly a heading of zero eight zero." At 2126:36, the final controller advised AVA052 that "...I'm going to bring you about fifteen miles northeast and then turn you back on for the approach is that fine with you and your fuel." The flightcrew replied, "I guess so thank you very much."

At 2129:19, the flightcrew asked, "When can you give us a final...," and the final controller responded, "...affirmative turn left heading zero four zero [degrees]." At 2130:36, the final controller recleared AVA052 to maintain 3,000 feet and the flightcrew replied, "Ah negative sir we we just running out of fuel we okay three thousand...." During the next two minutes, AVA052 was given three heading changes and then at 2132:51 the flightcrew advised, "...we just lost two engines and we need priority please." The final controller then turned the flight to a heading of two five zero degrees, advised that it was 15 miles from the outer marker and cleared for the ILS approach to runway two two left. At 2134:00, the final controller asked AVA052, "You have ah you have enough fuel to make it to the airport?" There was no response from the flightcrew.

Weather Conditions

During the period AVA052 was approaching the New York City metropolitan area through the time of the accident, the coastal sections of central and southern New England and the mid-Atlantic States were in the warm sector of a complex frontal system associated with a deep surface low over extreme northern Lake Huron. Conditions in the warm sector were characterized by low or obscured ceilings with visibilities reduced by rain, drizzle, and fog, and gusty south to southwesterly winds. At 2100, preceding the accident, the hourly weather observation for JFK was indefinite ceiling, 200 feet obscured, visibility 1/4 mile in light drizzle and fog. The wind was from 190° at 20 knots gusting to 28 knots, and the runway visual range measured at the approach end of runway 4R was 1,800 feet variable to 2,200 feet.

A special observation recorded for JFK at 2135, immediately after the accident, reported a partial obscuration with the ceiling measured 300 feet overcast, visibility 3/4 mile in fog. The wind was from 190° at 20 knots and the runway visual range measured at the approach end of runway 4R was 5,500 feet variable to 6,000 feet plus. At 1900, the winds aloft at Atlantic City, New Jersey, the upper air station closest to New York City, were observed to have been from 195° at 53 knots at 1,000 feet and from 200° at 50 knots at 2,000 feet. These weather conditions had a substantial and adverse effect on traffic operations at JFK. The low ceilings, low visibilities, and adverse wind conditions resulted in major delays to air carrier flights to and from JFK. Some flights were delayed at their departure points, others were delayed in holding patterns en route and in the terminal area, and many flights were diverted to their alternate or another airport.

Operational and Air Traffic Control Rules and Procedures

Commercial air carrier flightcrews must be thoroughly knowledgeable of the flight operating and ATC rules and procedures, including standard phraseology, for operating in the U.S. NAS, and must be particularly familiar with pilot duties and responsibilities affecting flight operations and safety which include fuel supply, emergency conditions, requests for assistance, declaring a state of minimum fuel, and declaring an emergency for additional ATC assistance to ensure a safe landing. This information is contained in several publications: Part I of Annex 6 to the Convention on International Civil Aviation, the U.S. Federal Aviation Regulations (FARs), the Air Carrier's Operational Specifications issued by the Administrator of the FAA, the U.S. Aeronautical Information Publication (AIP), the U.S. Airman's

Information Manual (AIM), Notices to Airmen, Advisory Circulars, and the U.S. Air Traffic Control Handbook 7110.65F. For example, the AIP, AIM, and 7110.65F all contain specific procedures, guidance, and phraseology for use by pilots when it is necessary to advise ATC of a "minimum fuel" status and for use by controllers when they receive such an advisory. The information is nearly identical in all three publications; that contained in the AIP follows (from Rules of the Air and Air Traffic Services, ATC Clearance and Separation--Pilot/Controller Roles and Responsibilities, Minimum Fuel Advisory, paragraph 6.15):

6.15 Minimum Fuel Advisory

6.15.1. Pilot

- Advise ATC of your "minimum fuel" status when your fuel supply has reached a state where, upon reaching destination, you cannot accept any undue delay.

- Be aware this is not an emergency situation but merely an advisory that indicates an emergency situation is possible should any undue delay occur.

- Be aware a minimum fuel advisory does not imply a need for traffic priority.

- If the remaining usable fuel supply suggests the need for traffic priority to ensure a safe landing you should declare an emergency, account low fuel, and report fuel remaining in minutes.

6.15.2. Controller

- When an aircraft declares a state of minimum fuel, relay this information to the facility to whom control jurisdiction is transferred.

- Be alert for any occurrence which might delay the aircraft.

Further, the AIP urges pilots to declare an emergency and request immediate assistance when they first become concerned about the safety of their flights. This guidance follows (from Search and Rescue, Procedures and Signals for Aircraft in Emergency, paragraph 4, Emergency Condition--Request Assistance):

4. Emergency Condition--Request Assistance

(a) Pilots do not hesitate to declare an emergency when they are faced with distress conditions such as fire, mechanical failure, or structural damage. However, some are reluctant to report an urgency condition when they encounter situations which may not be immediately perilous, but are potentially catastrophic. An aircraft is in at least an urgency condition the moment the pilot becomes doubtful about position, fuel endurance, weather, or any other condition that could adversely affect flight safety. This is the time to ask for help, not after the situation has developed into a distress condition.

> (b) Pilots who become apprehensive for their safety for any reason should request assistance immediately. Ready and willing help is available in the form of radio, radar, direction finding stations and other aircraft. Delay has caused accidents and cost lives. Safety is not a luxury. Take action.

The AIP, AIM, and 7110.65F contain the following terms pertaining to aircraft in emergency:

> EMERGENCY - A distress or an urgency condition.
>
> DISTRESS - A condition of being threatened by serious and/or imminent danger and of requiring immediate assistance.
>
> URGENCY - A condition of being concerned about safety and of requiring timely but not immediate assistance; a potential distress condition.
>
> MAYDAY - The international radio-telephony distress signal. When repeated three times, it indicates imminent and grave danger and that immediate assistance is requested.
>
> PAN-PAN - The international radio-telephony urgency signal. When repeated three times, indicates uncertainty or alert followed by the nature of the urgency.

Air traffic controllers have defined duties and responsibilities to provide ATC separation and service to users of the NAS. The procedures, guidelines, and phraseology are contained in 7110.65F. As it pertains to receipt of a "minimum fuel" advisory from a pilot, paragraph 2-8, Minimum Fuel, advises the controller:

> - If an aircraft declares a state of "minimum fuel," inform any facility to whom control jurisdiction is transferrred of the minimum fuel problem and be alert for any occurrence which might delay the aircraft en route.

Chapter 9, Emergencies, provides the controller with direction in how an emergency may be determined. Specifically, paragraph 9-1, Emergency Determinations, advises that an emergency can be either a distress or an urgent condition. A pilot who encounters a distress condition should declare an emergency with the word "mayday" repeated three times; and for an urgency condition, the word "pan-pan" should be used. Further, controllers are advised that if these words are not used and they are "in doubt that a situation constitutes an emergency or potential emergency, handle it as though it were an emergency." Finally, controllers are instructed that, "when you believe an emergency exists or is imminent, select and pursue a course of action which appears to be most appropriate under the circumstances and which most nearly conforms to the instructions in this manual."

Interviews With Air Traffic Controllers

All of the air traffic controllers who directly or indirectly provided service to the flightcrew of AVA052 were interviewed by Safety Board investigators. These interviews focused on what the controllers perceived and what their actions were in response to that information provided to them by the flightcrew of AVA052.

The radar controller at the NY ARTCC told Safety Board investigators that he had four airplanes, including AVA052, in the holding pattern at CAMRN that were destined for JFK. He was required to provide 20 miles-in-trail spacing between successive arrivals to the JFK airport. The controller was asked his interpretation of statements from the flightcrew, "I think we need priority" and "we'll be able to hold about five minutes that's all we can do." He stated that he believed the flightcrew was advising him they would only be able to stay in the holding pattern about 5 minutes and that they needed "priority" to come out of holding and proceed to the JFK airport. When asked why he requested information about the alternate airport from the flightcrew of AVA052, he stated that he wanted the information in the event the NY TRACON could not accept the airplane; he then would be able to develop another strategy for providing service. He was asked about his understanding of the statement "it was Boston but we can't do it now we ah we will run out of fuel now." He replied that he believed that by issuing the flightcrew an immediate clearance out of holding and toward the airport, he was complying with the pilot's request to shorten the time in the holding pattern; and since the airplane was being vectored to JFK, the lack of sufficient fuel to go to Boston was no longer relevant. He also stated that because he had complied with the pilot's request, there was no requirement to pass to the next facility the flightcrew's request for "priority." He stated that had the flightcrew advised that they were fuel critical, minimum fuel, or in an emergency situation, he would have provided them with emergency service.

The NY ARTCC handoff controller told Safety Board investigators that while monitoring the transmissions between the radar controller and airplanes, he immediately initiated coordination with the NY TRACON after hearing the flightcrew of AVA052 state that they would "be able to hold about five minutes and that's all we can do." He stated that he passed on this information and asked the NY TRACON controller if he could take the airplane or if the alternate airport should be offered to the flightcrew. Because the NY TRACON controller accepted the handoff on AVA052, the handoff controller stated that he believed he was fulfilling AVA052's request for priority by initiating action that would take the airplane out of the holding pattern. He did not believe the flightcrew's request constituted anything more than to leave the holding pattern. He stated that he did not believe it was necessary to pass on a request for "priority" if the request had been met. He stated that he did not hear the flightcrew of AVA052 inform the radar controller that, as a result of their fuel state, they could not reach their alternate airport, nor was this information given to him by the radar controller.

The NY TRACON feeder controller advised Safety Board investigators that when he was informed by the NY ARTCC handoff controller that AVA052 could only hold for 5 minutes, he believed that after that time (5 minutes) the airplane would have to proceed to its alternate airport. He stated that the flightcrew of AVA052 provided no information to him that indicated that the flight had minimum fuel problems, nor was he ever made aware that the flight could not reach its alternate airport.

The NY TRACON final controller advised Safety Board investigators that during the time AVA052 was receiving vectors for the first ILS approach to runway 22L, there were no communications pertaining to a minimum fuel status or to an urgent condition. The flight was given routine radar service, cleared for the approach, and then cleared to contact the JFK TOWER controller.

The JFK TOWER controller advised Safety Board investigators that, following the missed approach, he did recall the flightcrew of AVA052 telling him about a "fuel problem," but that he assumed the JFK TOWER assistant controller, who was monitoring his frequency, had heard this information and passed it to the NY TRACON. He also stated that he believed the flightcrew's comment meant that they could make another approach and then proceed to their alternate airport. The JFK TOWER assistant controller advised Safety Board investigators that he did not hear the flightcrew of AVA052 advise that they were running out of fuel because he was on an inter-phone line coordinating the flight's missed approach with the NY TRACON.

The NY TRACON final controller advised Safety Board investigators that when the flightcrew informed him following the missed approach, "...and uh we're running out of fuel sir," they did not convey anything urgent or an emergency situation which "triggered my sixth sense." He stated that the pilot's tone was very matter of fact. He stated that he turned the airplane on downwind right away and advised the flightcrew of AVA052 of his intentions to resequence the flight for landing. He asked the flightcrew, "...is that fine with you and your fuel," and they replied, "I guess so thank you very much." When the flightcrew of AVA052 advised him that they had just lost two engines, he understood this to mean that they had just lost the No. 2 engine, so he immediately turned the flight toward the localizer and then issued the approach clearance.

Discussion

The Safety Board is concerned that the flightcrew of AVA052 did not communicate either their "minimum fuel" or "emergency fuel" condition to ATC and did not use the proper phraseology if it was their intent to indicate either of those conditions. The flightcrew was certainly aware of the major delays for traffic landing at JFK after being held at ORF, BOTON, and CAMRN for a total of 1 hour 17 minutes. Also, while holding at CAMRN, the flightcrew advised ATC that they would run out of fuel if the flight had to proceed to its alternate airport at Boston. Later, they asked, "...do you have any estimates sir," and were advised by the NY ARTCC controller that "it's an indefinite hold at this time." Shortly thereafter, NY ARTCC issued the flight a third extension to hold for an additional 20 minutes at CAMRN until 2105. The flightcrew repeated the new EFC time and then stated, "...I think we need priority...." The communications by the flightcrew of AVA052 failed to alert the NY ARTCC controllers to a need for any priority beyond leaving the holding pattern.

Following the initial missed approach, the flightcrew told the JFK TOWER first and the NY TRACON second that "we're running out of fuel." While these messages were explicit, they, too, failed to alert the controllers to an emergency condition. The use of terms and phrases such as "I think we need priority," "it was Boston but we can't do it now we will run out of fuel now," "we're running out of fuel," and "when can you give us a final" may have been an attempt by the flightcrew to communicate to ATC that they were in an emergency condition. However, because precise terms such as "minimum fuel" and "emergency" were not included in the communications, the air traffic controllers did not attach a distress significance to them; hence, the information was not forwarded from facility to facility, and the flight was not provided with additional ATC assistance.

Controllers believed that they had satisfied the flight's request for priority and that it was not necessary to pass on the advisory that insufficient fuel was available to reach the alternate airport. Another controller, after being advised that the flight was running out of fuel, believed that his assistant controller had passed this information to the next control facility. A second controller, after receiving the same message twice, did not question the flight to determine the exact amount of fuel remaining in minutes of flying time. Instead, the flight was vectored 20 miles northeast of the airport where it was sequenced to land behind three other airplanes. Further inquiries by any one of these controllers to clarify the flightcrew's meaning and to determine the amount of fuel remaining, might have established that the flight was in a distress situation and, as a result, required additional ATC assistance and traffic priority to ensure a safe landing. The Safety Board believes that air traffic controllers should question flightcrews when there is any indication that flight safety may be compromised.

The Safety Board further believes that, to achieve a safe, orderly, and efficient flow of traffic in the NAS, both pilots and air traffic controllers must rigidly adhere to proper flight operating, ATC, and communication procedures. These are contained in appropriate international and governmental publications that include specific rules, regulations, procedures, and communications phraseology. The Safety Board believes that these operational and ATC rules and procedures are comprehensive and thorough. Both pilots and controllers must comply with them to achieve effective management of the NAS. Pilots-in-command are responsible for the safe operation of their aircraft, and controllers are responsible for aircraft separation and emergency assistance when it is requested. Both exist and interface in the NAS through continuous two-way communication involving clearances, advisories, pilot requests and reports, and occasionally the declaration of an emergency situation. The Safety Board believes that the contents of this safety recommendation letter should receive the widest distribution possible to commercial air carrier pilots, dispatchers, safety and training departments, and to air traffic controllers--all of whom are cooperative participants toward achieving the safest possible NAS.

The Safety Board is aware of similar misunderstandings of communications between flightcrews and air traffic controllers, especially in the traffic environment around New York City. The Safety Board is investigating at least three other incidents involving deficiencies in communication that occurred on and since January 25, 1990. Two of these incidents involve U.S. air carriers and the third, a foreign carrier. Also, the Safety Board notes that the FAA's recent System Safety and Efficiency Review of the Northeast Corridor of the U.S. identifies poor communications between pilots and controllers as a problem.[4] This review, which was prompted by the Safety Board's Safety Recommendation A-88-157 issued to the FAA on November 15, 1988, concludes that poor communications between pilots and controllers adversely affect the safety and efficiency of the NAS. Further, the review states that poor phraseology is one of the factors contributing to the communication problems "...which are significantly intensified within the Northeast Corridor's complex airspace." The Safety Board believes that difficulties in communication can be a serious problem for users operating in the NAS and, if not corrected, could lead to an erosion of safety. Therefore, the Safety Board urges the FAA to reemphasize to pilots and controllers the need to use proper procedures, phraseology, and good judgment during normal flight operations, and especially when confronted with or exposed to potential or actual emergency situations.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Immediately notify all domestic and foreign air carriers to emphasize that all pilots operating commercial air transport flights in the United States (U.S.) National Airspace System (NAS) must be thoroughly knowledgeable of the flight operating and air traffic control (ATC) rules and procedures, including standard phraseology, for operating in the U.S. NAS. This information is included in several publications: Part I of Annex 6 to the Convention on International Civil Aviation, the U.S Federal Aviation Regulations, the Air Carrier's Operational Specifications issued by the Administrator of the FAA, the U.S. Aeronautical Information Publication, the U.S. Airman's Information Manual, Notices to Airmen, Advisory Circulars, and the U.S. Air Traffic Control Handbook (7110.65F). Pilots must be particularly familiar with their duties and responsibilities affecting flight operations and safety which include fuel supply, emergency conditions, requests for assistance, declaring a state of minimum fuel, and declaring an emergency for additional ATC assistance to ensure a safe landing. (Class I, Urgent Action)(A-90-9)
>
> Immediately disseminate the contents of this safety recommendation letter (A-90-9 through -11) to all air carrier operators involved in commercial air transport operations in the United States National Airspace System. (Class I, Urgent Action)(A-90-10)
>
> Immediately issue a General Notice (GENOT) directing management of all air traffic control (ATC) facilities to formally brief all air traffic controllers on the circumstances of the January 25, 1990, accident of Avianca Airlines flight 052 and to emphasize the need to request from flightcrews clarification of unclear or ambiguous transmissions that convey a possible emergency situation or the need for additional ATC assistance. (Class I, Urgent Action)(A-90-11)

KOLSTAD, Chairman, COUGHLIN, Acting Vice Chairman, and LAUBER, Member, concurred in these recommendations. BURNETT, Member, did not concur.

By: James L. Kolstad
Chairman

Footnotes appear on page 12

Footnotes

[1] All times shown are eastern standard and based on the 24-hour clock.

[2] Flight level is a level of constant atmospheric pressure related to a reference datum of 29.92 inches of mercury. Each level is stated in three digits that represent hundreds of feet. For example, level 370 represents a barometric altimeter indication of 37,000 feet.

[3] All altitudes are expressed in terms of mean sea level (msl) unless otherwise indicated.

[4] System Safety and Efficiency Review, Northeast Corridor Issues, Volume 2: FAA Team Discussion and Recommendations, June 12, 1989, Issue 16: Communication Awareness Between Pilots and Air Traffic Control Specialists.

What's Your Input?

Flight Safety Foundation welcomes articles and papers for publication. If you have an article proposal, a completed manuscript or a technical paper that may be appropriate for *Accident Prevention* please contact the editor. Submitted materials are evaluated for suitability and a cash stipend is paid upon publication. Request a copy of "Editorial Guidelines for Flight Safety Foundation Writers."

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Testimony Provided by the Radio Technical Commission for Aeronautics and Prepared for the U. S. House of Representatives Committee on Public Works and Transportation Aviation Subcommittee regarding Pilot/Air Traffic Controller Communications Issues

June 11, 1990

The Radio Technical Commission for Aeronautics (RTCA) welcomes this opportunity to offer its views regarding Pilot/Air Traffic Controller communications -- a timely, important and challenging issue. The Subcommittee has clearly identified a problem that affects safety, and impacts on the entire aviation industry -- pilots, controllers and everyone who uses the air commerce system. We congratulate the Committee for its initiative in this area and believe that we can offer some useful insights into both the nature of the issue and viable approaches for helping to reduce attendant challenges.

By way of background, we would like to take a moment and acquaint the Committee with our organization. RTCA is a private, non-profit organization that has been helping to shape the future of aviation through the application of electronics and telecommunications since 1935. We provide the means by which government and industry representatives gather to address aviation requirements in the context of current and emerging technology, to develop minimum operational performance standards and to prepare technical guidance documents. Our recommendations, by virtue of our Federal Advisory Committee status, often provide the basis for Federal Aviation Administration (FAA) Technical Standard Orders and the foundation for decisions regarding international aviation policies and avionics standards. Our membership includes essentially all segments of the U.S. aviation industry -- representatives from the Departments of Transportation, Commerce and Defense, the airlines, business aviation, general aviation, airframe manufacturers and both aviation equipment and service suppliers. Our membership, when combined with our International Associates, embrace a broad cross-section of the world aviation community.

RTCA serves the aviation industry by developing a government/industry consensus on aviation issues and recommended solutions. We form Special Committees staffed by volunteer experts, to address individual aeronautical issues. Our Special Committees meet in open forum; take comments, views and opinions from all interested parties and then develop a consensus position on each issue. Special Committee recommendations are codified in RTCA documents which are often used by the FAA in making regulatory decisions and by industry in making business decisions. Enclosure 1 summarizes issues addressed by RTCA Special Committees and documents since the mid-1950s. We believe that our unique approach to aeronautical issue identification/issue resolution has consistently provided the entire community with the best possible solutions to current and anticipated issues -- and done so at very little direct cost to the government.

Turning to the issue at hand, pilot/air traffic controller communications are essential to the safe and efficient operation of the air commerce system. Years ago, when fewer aircraft were flying and fewer air space restrictions were needed or in place, pilot/controller communications were uncomplicated and efficient. With major increases in air commerce throughout the world, the need to communicate between the aircraft and the ground has increased due both to the greater number of aircraft using the air space and to the requirements placed on aircraft operations. Today, the volume of air-ground communications, particularly at our busier airports, is such that pilots and controllers must at times wait to make a transmission and even then, on some occasions, find that their messages are "blocked" by other pilots and controllers trying to transmit on the same frequency at the same time. Occasionally, an emergency exists during which air crews and controllers can't wait for a clear channel. Hence the pressing need to find a solution --- or more appropriately a family of complementary solutions --- to this safety oriented, aviation issue.

To put the issue in perspective, controllers and air crews must communicate before, during and after every flight. Controllers issue instructions for take-off, altitudes and headings to fly and frequencies on which to communicate, as well as approvals to taxi, to take-off and to land. Controllers also use the communications network to issue advisories that help assure aircraft separation and inform pilots about terminal and en route weather. Other controller issued advisories address airport operating conditions --- including runways in use, wind direction and speed, altimeter settings etc. Air crews, in turn, use air-ground communications to request advisories, to acknowledge controller instructions, to pass operational and administrative messages and when necessary, to declare emergencies and request assistance. Traditionally, air-ground communications have been exclusively conducted using voice, i.e., pilots and controllers talking to each other via microphones -- an effective albeit somewhat inefficient method of communication.

As indicated earlier, pilot/air traffic controller communications warrant special attention because at some airports and under some flight conditions, all available frequencies are in use and the volume of voice traffic exceeds the available time-frequency commodity that is allocated for communications. The net result --- occasionally messages are delayed and some messages can't get through. A tragic example of this was the collision of two 747's in Tenerife because one of the pilots spoke when the controller paused while giving his instructions. The resultant squeal blocked the rest of the controller's message plus the announcement that that pilot was taking off.

In the specification and design of almost all aircraft electronic equipment, the issue of pilot/operator interface is a constant and critical issue. This interface directly carries forward to the interface between the pilot and the controller as they cooperatively perform their corollary functions of providing safe and efficient air transportation. Specification of functional modes of such equipment must, at all times, consider how best to communicate both instructions and intentions between the pilot/airborne equipment and the air traffic controller/ground-based ATC equipment.

In carrying out the RTCA charter of developing industry/government standards for airborne electronic equipment, most RTCA Special Committees identify an Operational Requirements Working Group as a major element in their deliberations. It is usually the responsibility of this working group to define the modes under which the new or modified system will operate, including the critical issue of pilot/controller communications. RTCA contributions to this vital topic are reflected in many documents and recommendations. It may be helpful to summarize some of our initiatives in this functional area.

Special Committees 41 and 42 - These RTCA Special Committees, titled "Operational and Technical Characteristics of a Transition Period - Air Traffic Control Communication System and a Study of its Operational and Economic Values," produced the basic document that laid the foundation for a communication system between pilots and controllers. This document provided the framework for the air-ground method of voice communication which still exists today.

Special Committees 137 and 151 - The concept of area navigation, a technique of navigating aircraft from point-to-point in an optimum straight-line manner, required the generation of new and innovative means of pilot/controller communications to free up available radio channel time and to minimize possible misunderstandings and/or errors in voice communications. As a direct result of the deliberations of these two committees, one dealing with various forms of radio navigation sensors and the other with the microwave landing system, extensive FAA simulations were performed to test the feasibility of several new concepts. In addition to defining the functional and operational characteristics of the airborne equipment, these simulations facilitated considerable progress in the development of standardized pilot/controller phraseology -- explicitly to minimize both communications time and possible errors in interpretation.

Special Committee 142 - Driven by the combination of emerging technology and the greatly increased demand for air-ground communications capability, this committee developed Minimum Operational Performance Standards for a Mode S Data Link Processor. Mode S is a data link concept, intended to pass important aircraft flight data automatically, at high speed, from airborne computer to ground computer, with little or no pilot/controller involvement --- or voice communications. During the Special Committee deliberations much attention was given to message content, protocols, and failure/error protection to assure safe flight operations would be sustained or enhanced.

Special Committee 147 - This committee was specifically formed to develop standards for a Traffic Alert and Collision Avoidance System (TCAS), the concept for which embodied air-to-air collision avoidance, divorced from direct voice interaction between the pilot and the air traffic controller. Aspects of collision avoidance computational methodology and cockpit-generated voice commands are being integrated into the more traditional role of controller/pilot verbal interaction for collision avoidance. Again, standardization of procedures and phraseology formed a large part of the deliberations and conclusions of this committee. Convened in 1980, this committee is still active, supporting the move toward near-term operational implementation of TCAS as an integral element of our air traffic control system.

Special Committee 163 - In 1986, RTCA convened Special Committee 163, Unintentional or Simultaneous Transmissions that Adversely Affect Two-way Radio Communications, to address in detail the issue of pilot/air traffic controller "blocked" voice communications. Although this Special Committee has not yet completed its work, an insight into its deliberations may prove especially helpful.

Simply stated, voice communications are blocked when two or more transmitters in the same general area are inadvertently operating on the same frequency. Any attempt to speak while someone else is transmitting on that frequency, will cause a squeal that will render both messages unintelligible. There are two causes of blocked pilot/controller communications: Unintentional continuous transmissions; and simultaneous transmissions.

Unintentional continuous transmission are typically caused by equipment malfunctions or the unwitting activation of the microphone push-to-talk switch. When this happens, no one else can use that frequency until the offending transmitter is turned off and the culprit is usually the last to discover the problem.

Simultaneous transmissions occur when two or more people try to speak at the same time on the same frequency, either because one isn't paying attention or more probably because both are trying to speak and accidently transmit at the same time. The vast majority of pilots and ground personnel are aware of the need for good, disciplined radio procedures and will not knowingly transmit when someone else is using the frequency.

In addressing the problem of blocked communications, Special Committee 163 considered methods to clear a blocked frequency, alternatives to accommodate the emergency transmissions that must occasionally be made and techniques to cope with this challenge considering the varied transceivers currently in use.

Looking first at unintentional transmissions, the committee is addressing the use of a "timer" device to automatically inhibit transmissions after a short --- measured in tens of seconds --- predetermined time period. While this approach may prove beneficial for the "stuck microphone" button problem, it presents operational challenges whenever long messages such as the read back of detailed flight clearances or long passenger lists must be transmitted.

Turning to simultaneous transmission, the committee is looking into devices, to be incorporated into aviation receivers, that inhibit a transmitter from operating whenever a signal is being received on the same frequency. Evidence and analysis to date suggests that the issue of conflicting simultaneous transmissions is very complex, due in part to the wide ranging design parameters of equipment currently in operation throughout the aviation industry. Furthermore, the issue is exacerbated by two considerations: (1) The need for an override capability to facilitate emergency communications and (2) an approach that is compatible with simultaneous transmissions that are a fact-of-life at those airports most heavily used by general aviation aircraft where several airports in the same general area operate on the same single frequency. Current analysis suggests that the design and implementation of an override switch would provide an appropriate technical solution to these issues, however, use of the bypass switch will likely lead to new operational issues.

The committee is attempting to assess the degree of success that can be anticipated using the "timer" to turn off transmitters after a specified period of time and the implementation of designs to inhibit simultaneous transmissions but include the use of an override switch in the event of an emergency. Current analysis indicates that implementation of these solutions may reduce blocked transmissions by approximately 50 percent based on the design parameters of inventory transceivers. Implementation in new, higher technology transceivers may further reduce blocked frequencies, however, it is likely that no solution can eliminate the problem. Special Committee 163 analysis is still underway.

Special Committee 166 - Formed in November 1988 and still busily at work, this committee is dealing with User Requirements for Future Airport and Terminal Area Communication, Navigation and Surveillance Systems. Integral to this subject of operations in the crowded airspace surrounding terminal areas is the necessity to improve the safety and efficiency of air-ground communications. As in Special Committee 142, the subject of data link as an adjunct to voice communications is very evident in Special Committee 166.

The use of data links offers a potential solution to pilot/air traffic controller communications. Data links pass computer-to-computer information between aircraft and the ground and offer many advantages: They can transfer great quantities of data in fractions of a second, provide high quality, error-free communications, and information conveyed via data link can be instantly displayed via paper print-outs or on cathode ray tubes, i.e., TVs located in the cockpit. Data link communications can be presented in either text or graphic format. Furthermore, data link communications are effective and efficient over a wide portion of the frequency spectrum. The liability of data link is that information must formatted prior to transmission. While formatting is quick and easy in the case of lists, altitudes, headings, airspeeds, etc., the nature of information passed during emergencies is not conducive to formatting. While data links can go a long way toward helping to off-load the over-burdened pilot/air traffic controller communications, some voice communications will always be required.

Technology, when used in conjunction with improved procedures, can reduce the current pilot/air traffic controller communications challenge. Progress is being made. The solution will be evolutionary in nature and considerable time and resources will be needed to effect major improvements. Critical to any effort focused on this issue is the need for an integrated system approach to the problem. Just changing procedures, just allocating more frequencies, just increasing automation or the use of data link will not in and of itself resolve the issue. A total system approach must be pursued. Functions requiring pilot/air traffic controller communications must be reviewed, capabilities promised by technology assessed, current procedures reviewed and challenged, development supported and regulatory and business decisions taken based on recognizing the size and importance of this issue as well as the potential benefits/advantages promised by technology --- all viewed in the context of pilot and controller needs. The evolution requires a concept, requirements, planning, fiscal and regulatory decisions and support of the entire industry to effect the needed changes.

Pilot/air traffic controller communications can be improved -- but it will take time, talent and commitment. The spot light that this committee has focused on this important subject will undoubtedly help in sustaining the momentum and possibly accelerating the process of resolving this important issue at an early date.

We appreciate the opportunity to offer our views on this topic and stand ready to assist in the future where appropriate.

60 Maple Grove Road
Hanover, PA 17331
717/632-4345

June 19, 1990

The Honorable James L. Oberstar
Chairman
Subcommittee on Aviation
Room 2251, Rayburn Building
Washington, DC 20515

SUBJECT: Pilot/Airtraffic Controller Communications Issues

Dear Sir:

The need for improved pilot/controller communications is obvious, and I appreciate this opportunity to present my views on the subject for the record of your committee.

Compared to other ways of improving pilot/controller communications, anti-blocking radio equipment presents the most tangible and least expensive approach. The concept of anti-blocking is simple; prevent one pilot's radio voice transmission from stepping-on or interfering with an ongoing transmission of another. The FAA was made aware of workable prototype equipment from several sources about eight years ago.

Considering safety and hoping for prompt action, I personally contacted the FAA in 1982. Early contacts by myself and others did not result in organized action from the FAA, although there were individuals in that organization who offered encouragement and help. One individual suggested petitioning.

The Petition 84-PR-5, Docket No. 23755, which records a large majority of supportive responses for anti-blocking also had some negative responses Some early opposition evidently was formulated prior to a complete understanding of how anti-blocking equipment really works. One company responded negatively to the petition by stating some theoretical arguments; it continues to object about step-on protection on a theoretical basis to this date. Their argument is based on questionable assumptions. Considerable demonstrations of anti-blocking equipment and successful in-flight testing prove that the equipment is effective. There has been continued and almost unanimous acceptance of anti-blocking equipment by controllers and pilots who have witnessed demonstrations in the air or on the ground. A demonstration of such equipment to an Aircraft Owners and Pilots Association (AOPA) meeting of 63 flight instructors resulted in favorable written comments from 61 of them and negative comments from two.

The Radio Technical Commission for Aeronautics (RTCA) Committee SC163, with representation from across the aviation industry, took over three years and arrived at Minimum Operational Performance Standards for Devices that Prevent Blocked Channels Used in Two-Way Radio Communications Due to Unintentional and/or Simultaneous Transmissions, (MOPS). These (MOPS) await final RTCA Executive Board approval. Some theoretical argument will again be voiced against adoption of the complete document. For maximum safety, the MOPS should be accepted as written since the unintentional and simultaneous transmissions are equally dangerous to communications. A halfway measure will not be sufficient.

Meanwhile, the FAA should and can proceed with the rulemaking that is suggested in the Petition without awaiting final approval of the MOPS by the RTCA Executive Board.

The cost of anti-blocking equipment will be small compared to other communications improvements such as on board printers or digital video type display screens which may be too expensive for the small plane owner/operator. An anti-blocking microphone will cost about $30.00 more than an unimproved microphone. Anti-blocking protection will increase the cost of manufacturing a radio by as little as two (2%) percent. The owner/operator will have a choice of buying anti-blocking protection in one of the following: a) a new radio, audio panel, or microphone, or b) modifying his existing radio, audio panel, or microphone. A modified microphone was flight tested and granted a Supplemental Type Certificate (see enclosure). The MOPS can be met without any new lights or switches being added to the cockpit; additional switches or warning lights are optional.

My engineering background and 37 years of flying, most recently as an international captain, have given me exposure to this problem on every flight. The expression of this need has been long standing, and the need for action is here. Full implementation of the complete MOPS as now written will give protection against simultaneous blockage and stuck microphones. The FAA should be required to proceed with rulemaking calling for anti-blocking equipment in high density airspace.

Your interest and that of your committee is appreciated. Under your guidance, hopefully the FAA will move forward on this matter. Thank you for this opportunity to comment on an important problem.

Respectfully,

John G. Rutty
Captain

JGR/mau

Enclosure

United States of America

Department of Transportation—Federal Aviation Administration

Supplemental Type Certificate

Number SA243NE

This certificate, issued to

Mr. John G. Rutty
60 Maple Grove Road
Hanover, Pennsylvania 17331

certifies that the change in the type design for the following product with the limitations and conditions therefor as specified herein meets the airworthiness requirements of Part 3/23 *of the* Civil Air/Federal Aviation *Regulations.*

Original Product—Type Certificate Number: 3A12
Make: Cessna Aircraft Company
Model: 172

Description of Type Design Change:

Configuration 1: Installation of "Anti Blocking Device" in series with the microphone for ARC Radio, Model 300, Type RT-385A.

OR

Configuration 2: Addition of a green indicator light to the "Anti Blocking Device" to indicate when microphone is not transmitting, in accordance with Anti Blocking Device, Fig. 4A, dated May 25, 1984.

(See STC Continuation Sheet, Page 2)

Limitations and Conditions:

This approval should not be incorporated in any aircraft of these specific models on which other approved modifications are incorporated, unless it is determined that the interrelationship between this change and any of those previously incorporated approved modifications will not introduce any adverse effect upon the airworthiness of the aircraft.

This certificate and the supporting data which is the basis for approval shall remain in effect until surrendered, suspended, revoked, or a termination date is otherwise established by the Administrator of the Federal Aviation Administration.

Date of application: July 22, 1983
Date reissued:
Date of issuance: March 8, 1984
Date amended: 10/15/84, 12/13/85

By direction of the Administrator

Raymond J. Borowski
(Signature)
Raymond J. Borowski
Manager, NY Aircraft Certification Office
(Title)

Any alteration of this certificate is punishable by a fine of not exceeding $1,000, or imprisonment not exceeding 3 years, or both.

This certificate may be transferred in accordance with FAR 21.47.

FAA Form 8110-2 (10-68)

PAGE 1 OF 2 PAGES

(Continuation Sheet)

Number SA243NE
Date amended: December 13, 1985

Description of Type Design Change:

Configuration 3: Installation of "Anti Blocking Device" in a Telex 66C microphone, with the addition of a green indicator light and bypass switch in microphone, in accordance with Fig. 3 of "ABD ADDED TO MICROPHONE", dated October 2, 1985.